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State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

NINTH REPORT OF THE STATE ENTOMOLOGIST, 1909

W. E. BRITTON, PH.D.

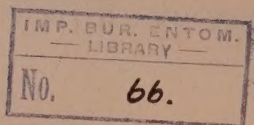
BEING PART IV OF THE BIENNIAL REPORT OF 1909-1910

NINTH REPORT
OF THE
STATE ENTOMOLOGIST
OF
CONNECTICUT
FOR THE YEAR 1909

BY
W. E. BRITTON, PH.D.
State Entomologist

New Haven, Conn.

1910



CONTENTS

	Page
Letter of Submittal,	323
Report of Receipts and Expenditures,	323
Office Force and Field Organization,	324
Lectures, Correspondence and Summary of Inspection Work,	325
Exhibits,	325
Publications from the Entomological Department, 1909,	326
Inspection of Nurseries,	326
List of Nursery Firms receiving certificates in 1909,	327
Inspection of Imported Nursery Stock,	328
Provision for the Inspection of Apiaries to suppress contagious diseases of bees,	331
Municipal Spraying of Elm Trees in Connecticut in 1909,	334
Combating the Gypsy Moth in Connecticut,	336
Stonington Infestation,	336
Wallingford Infestation,	337
Discovery of the Gypsy Moth at Wallingford,	337
Destroying Egg-Masses,	338
Educational Work in Wallingford,	340
Warning Notices Scattered over the State,	340
How did the Pest reach Wallingford?	342
Organization and Progress of the Suppression Work,	342
The Rosy Apple Aphis,	343
Difference Between the Green and Rosy Apple Aphids,	344
Life History,	345
Description,	345
Parasites of Rosy Apple Aphis,	351
Other Host Plant Still Unknown,	351
Remedial Treatment,	351
Literature,	352
The Bud Moth,	353
Origin, Distribution and Past Record,	353
General Appearance,	354
Life History,	354
Remedies,	355
Literature,	355
The Leopard Moth,	356
Distribution and Spread in America,	356
Trees and Shrubs Attacked,	357
Appearance of Infested Trees,	357
Life History and Habits,	357
Appearance of the Insect,	358
Remedies,	358
Literature,	359

	Page
The Peach Borer,	359
Effect Upon Trees,	359
Habits and Life History,	360
Food Plants,	360
Appearance of Insects,	361
Remedial Treatment,	361
Mosquito Breeding Areas Examined at the Request of Health Officers,	362
Fumigating Buildings with Hydrocyanic Acid Gas,	365
Miscellaneous Insect Notes,	367
Tobacco Bud Worm in Connecticut,	367
Canker Worms,	368
The Greenhouse Leaf-tyer,	369
Strawberry Crown Girdler Attacking Young Hemlocks,	370
White Grubs in Grass Lands,	372
White Ants Injuring a House in South Norwalk,	373
Green Rose Chafer in Package of Nursery Stock Imported from Europe,	374

ILLUSTRATIONS.

Figure 1 is from a tracing made by Mr. A. B. Champlain from the map in the Wallingford directory. Figure 2 was reproduced directly from the printed card. Figure 3 is from camera lucida drawings by Mr. A. I. Bourne. Figure 7 is from a pen drawing by Mr. D. J. Caffrey. Figures 4, 5, 6, 8 and 9 are from pen drawings by Mrs. E. L. Beutenmuller.

All plates are from photographs by Mr. B. H. Walden, XV b and c being photographs of illustrations in the Monograph of the Sesiidae, by William Beutenmuller, published by the American Museum of Natural History of New York City.

PART IV.

NINTH REPORT

OF THE

STATE ENTOMOLOGIST OF CONNECTICUT

*To the Director and Board of Control of the Connecticut
Agricultural Experiment Station:*

In the transmission of this my ninth annual report as state entomologist of Connecticut I have followed the custom of preceding years. The report covers the calendar year of 1909, except the financial statements, which are for the fiscal year ending September 30th, 1909.

Respectfully submitted,

W. E. BRITTON,

State Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST
FROM OCTOBER 1ST, 1908, TO SEPTEMBER 30TH, 1909.

Insect Pest Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	\$3,000.00
Account of 1907, balance	779.47
Sale of duplicate pamphlet	.50
	\$3,779.97

EXPENDITURES.

For field, office and laboratory assistance	\$1,740.76
Printing and illustrations	55.15
Postage	53.62
Stationery	12.15
Telegraph and telephone	1.09
Express, freight and cartage	16.36

Library	\$89.13
Laboratory, apparatus and supplies	393.15
Office supplies	15.26
Traveling expenses	251.44
Balance, cash on hand	1,151.86
	\$3,779.97

Gypsy Moth Control Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	\$1,500.00
Account of 1908, balance	3.22
	\$1,503.22

EXPENDITURES.

For salary of superintendent, and labor	\$802.60
Printing	1.60
Tools and supplies	111.55
Express, freight and cartage	30.61
Traveling expenses	146.64
Balance, cash on hand	410.22
	\$1,503.22

Memorandum:—This account of the state entomologist has been duly audited by the State Auditors of Public Accounts.

OFFICE FORCE AND FIELD ORGANIZATION.

Mr. B. H. Walden has continued as general assistant and Miss E. B. Whittlesey as stenographer, as in former years. Mr. G. H. Hollister, who has been in charge of the gypsy moth work at Stonington, on account of the success of that work in reducing the number of the insects was not needed for the whole season. After the scouting Mr. Hollister was employed by the H. L. Frost & Bartlett Company from February 1st until July 1st, when he worked at Stonington until August 20th, and then helped in the nursery inspection. On October 16th Mr. Hollister began his duties as forester of Keney Park, Hartford, where he has charge of pruning, planting, spraying and removing trees. We were, however, able to secure his services at Stonington in scouting work during the week ending December 18th. Mr. Hollister was also able to assist us at Wallingford the following week in destroying egg-masses of the gypsy moth, which had just been discovered there.

Mr. Arthur I. Bourne, A.B., a graduate of Dartmouth College, and a graduate student in entomology at the Massachusetts Agri-

cultural College at Amherst, was employed from June 23d to November 1st, most of the time working on aphids, but helping with the nursery inspection work when needed.

LECTURES, CORRESPONDENCE AND SUMMARY OF INSPECTION WORK.

During the calendar year of 1909, twenty-two lectures have been given before granges and other agricultural meetings and scientific societies. Fifteen of these were illustrated with lantern slides. Of inspections, forty-nine nurseries have been examined, forty-eight certificates granted, and thirty orchards, gardens and greenhouses have been examined for pests; 224 boxes and packages of imported nursery stock were inspected at their points of destination and fifty-two winter nests of the brown-tail moth found and destroyed; 249 samples of insects and their work received for identification; 1,514 letters and thirty-three packages relating to the work of this office have been sent out.

EXHIBITS.

The entomological department has taken part in five exhibits during the year. During the week ending September 18th the Station had an exhibit of its work at the State Fair at Berlin. Many cases of pinned insects were shown, as well as life history sets and Riker mounts of species which are especially injurious in Connecticut. Photographs and charts were also a part of the display, but what attracted the most attention and excited the most interest was about twenty jars and cages of living insects. These included mosquitoes (both *Anopheles*, the malarial kind, and *Culex*, the non-malarial ones) and several kinds of good-sized larvæ like tobacco worms, cecropia, io and tussock caterpillars, which could be obtained at that season of the year.

Several dozen Riker mounts of insects were shown in New York City early in October in connection with the general Station exhibit at the Jewish Farmers' Fair.

Special exhibits in Riker mounts were made in connection with the entomologists of the other New England States at the New England Fruit Show, held in Boston the middle of Octo-

ber, and at the meetings of the Entomological Society of America, also held in Boston the last week in December.

At the meeting of the State Board of Agriculture in New Haven the second week in December, a large exhibit was made by the Station, considerable material being furnished by the entomological department.

PUBLICATIONS FROM THE ENTOMOLOGICAL DEPARTMENT, 1909.

Eighth Report of the State Entomologist (Part XI of the Station Report for 1907-08); 86 pages, 20 text figures, xviii plates. 9,000 copies, distributed in March, 1909.

Report of Committee on Injurious Insects, W. E. Britton, Chairman, read at the annual meeting, February 3, 1909. Report of the Connecticut Pomological Society, 1909, p. 24; 4 pages.

The San José Scale. *Connecticut Farmer*, April 10, 1909.

The Peach Sawfly. Correspondence slip, illustrated, reprinted in *Connecticut Farmer*, June 26, 1909.

Spraying Potatoes. Correspondence slip, illustrated, June, 1909.

Book Review, "Our Insect Friends and Enemies," by John B. Smith, Sc.D., Professor of Entomology in Rutgers College and Entomologist of the New Jersey Agricultural Experiment Station. *Science*, Vol. XXX, p. 283, Aug. 27, 1909.

Connecticut Laws Relating to the Suppression of Insect Pests, Plant Diseases, and Contagious Diseases of Bees. September, 1909.

Canker Worms. Correspondence slip, illustrated, October, 1909.

Bulletin 165. The San José Scale and Methods of Controlling It, by W. E. Britton. 24 pages, 13 figures. 11,000 copies. November, 1909.

The San José Scale. Correspondence slip, illustrated, November, 1909.

The Cocoons on the Sassafras Tree. *Guide to Nature*, December, 1909.

Gypsy Moth at Wallingford. *Connecticut Farmer*, December 25, 1909.

INSPECTION OF NURSERIES.

This work was commenced August 30th, and was nearly all finished before November 1st. It was done by Messrs. Walden, Hollister, Bourne and Britton.

The accompanying list of nurserymen contains forty-seven names as against forty last year. One nursery was inspected in the spring and forty-eight in the fall. One of these nurseries being attached, the owner could not carry out the treatment prescribed by the state entomologist, which was necessary in order to obtain the certificate. One firm had no stock to inspect, and was dropped from the list, and nine new

firms have started in the business. Two of these were started especially for growing seedlings for forest planting, but plainly must be inspected under the law. Some of the others make a specialty of ornamental stock with a view to supplying the local trade. The condition of the nurseries was on the whole rather better than last year, as many of the nurserymen now understand how to keep their stock free from scale and are giving this feature of the business much more attention than a few years ago. The list of firms receiving certificates in 1909 follows:

LIST OF NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1909.

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Atwater, C. W.	Collinsville	Oct. 6,	334
Barnes Bros. Nursery Co.	Yalesville	Sept. 22,	329
Beattie, Wm. H.	New Haven	Oct. 20,	355
Bowditch, J. H.	Pomfret Center ...	Oct. 8,	339
Brainard, D. Wm. & C. F.	Thompsonville ...	Oct. 12,	344
Braley & Co., S. A.	Burnside	Nov. 1,	364
Burroughs, Thos. E.	Deep River	Oct. 18,	350
Burr & Co., C. R.	(Manchester, Buck- land, Durham,)	(Sept. 14,	328
Chapman, C. E.	North Stonington..	Oct. 13,	347
Comstock & Lyon	Norwalk	Oct. 27,	360
Conine Nursery Co., The F. E. ...	Stratford	Oct. 7,	336
Conn. Agricultural College	Storrs	Dec. 7,	369
Conn. Agr. Experiment Station, Forest Nursery (S. N. Spring, State Forester, New Haven)...	Rainbow (Windsor)	Oct. 13,	346
Conway, W. B.	New Haven	Oct. 20,	356
Dehn & Bertolf	Greenwich	Oct. 9,	342
Dwyer, John E.	Manchester	Sept. 24,	330
East Rock Park Nursery (G. X. Amrhyn, Supt.)	New Haven	Sept. 7,	325
Elm City Nursery Co.	New Haven	Sept. 11,	326
Fernwood Nursery	Stamford	Nov. 16,	367
Gardner's Nurseries	Cromwell	Oct. 27,	359
Gurney & Co., H. H.	New Canaan	Oct. 5,	332
Hale, J. H.	So. Glastonbury...	Nov. 23,	368
Holcomb, Irving	Granby	Oct. 2,	331
Houston & Sons, J. R.	Mansfield Depot ..	Nov. 15,	366
Hoyt's Sons Co., Stephen	New Canaan	Oct. 5,	333
Hubbard & Co., Paul M.	Bristol	Oct. 18,	351
Hunt & Co., W. W.	Hartford	Oct. 8,	338
Kelsey & Sons, David S.	West Hartford	Oct. 7,	337

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Keney Park Nursery (G. A. Parker, Supt.)-----	Hartford-----	Nov. 1,	365
Malone, Geo. W.-----	Highwood-----	Dec. 31,	371
Mitchell & Co.-----	Manchester-----	Oct. 22,	357
Mount Carmel Forest and Nursery Co.-----	Mt. Carmel-----	Oct. 11,	343
North-Eastern Forestry Co.-----	{ Hamden and East } Haven	{ Oct. 8,	340
New Haven Nursery Co.-----	New Haven-----	Oct. 29,	363
Phelps, J. Wesson-----	Bolton-----	Oct. 29,	362
Pierson, A. N.-----	Cromwell-----	Sept. 14,	327
Platt Co., The Frank S.-----	New Haven-----	Oct. 27,	361
Purinton, C. O.-----	Hartford-----	Oct. 18,	352
Rosemore Nursery Co.-----	Litchfield (2)-----	Oct. 20,	354
Ryther, O. E.-----	Norwich-----	Oct. 25,	358
Schleichert, F. C.-----	Bridgeport-----	Oct. 15,	349
Schoonman, W. J.-----	Danielson-----	Dec. 17,	370
Scott, J. W.-----	Hartford-----	Oct. 12,	345
Sierman, C. H.-----	Hartford-----	Oct. 7,	335
Stannard, Mrs. E. P.-----	Westbrook-----	Oct. 13,	348
Vidbourne & Co., J.-----	Hartford-----	Oct. 9,	341
Woodruff, C. V.-----	Orange-----	Oct. 18,	353

INSPECTION OF IMPORTED NURSERY STOCK.

BY W. E. BRITTON AND B. H. WALDEN.

On January 10th, 1909, we received notice from Mr. George G. Atwood, Chief of the Division of Horticulture of the State Department of Agriculture, Albany, N. Y., that nests of the brown-tail moth, *Euproctis chrysorrhæa*, Linn., had been found on nursery stock brought into this country from France, and Mr. Atwood instructed us regarding the measures planned for handling such stock in New York City.

Though we are expecting each year to find the brown-tail moth in this State because of its natural spread from Massachusetts or Rhode Island, we cannot run the risk of its being brought into the State on nursery stock through lack of thorough inspection. An attempt was made, therefore, to inspect all importations so far as we could learn about them. On February 4th, Mr. Walden examined some stock at the nursery of C. R. Burr & Co., of Manchester, Conn., which had been grown by Louis Leroy, Angers, France. Some of the fruit

tree seedlings were found infested by nests of the brown-tail moth which were usually on the extreme tops of the shoots and were therefore rather conspicuous. The following notice was at once issued and sent to all nurserymen of the state:—

NEW HAVEN, February 5, 1909.

Dear Sir:—Several winter nests of the brown-tail moth *Euproctis chrysorrhoea* have just been found on nursery stock imported from France into Connecticut. The dangerously injurious nature of this pest is well known from its ravages in Massachusetts, New Hampshire and Maine, and, if possible, its further distribution and spread in this country must be prevented. I therefore request you to notify me at once of any importations received during the fall or winter and of any shipments expected this spring, so that inspection can be made. Please hold boxes until an inspector can reach your nursery before unpacking them. This is an important matter.

Very truly yours,

W. E. BRITTON,

State Entomologist.

The accompanying table shows the details of the examination of this imported stock.

In all 224 boxes and packages were examined, and the work necessitated 51 trips and the equivalent of 48 days' work for one man. Most of this inspecting was done by Mr. Walden, but Messrs. Hubbell and Britton also examined some of the stock. This work, though involving considerable time and expense which was needed for investigation, was deemed so important that it was not safe to neglect it.

Of all the stock inspected, only one lot, containing thirteen large boxes from the nursery of Louis Leroy, Angers, France, imported through the agency of H. Frank Darrow, 26 Barclay Street, New York City, was found infested. The boxes on arrival were all placed together in a barn, where they were kept for some time before being unpacked and before we knew of their arrival. Fifty-two winter nests of the brown-tail moth were found on fruit seedlings, a few on pear and quince, but most of them were on apple and dwarf apple stock. These nests contained living caterpillars. Some of the caterpillars leave their nests when in a warm place, and for this reason it was thought unsafe to allow the stock to go untreated. The nests were clipped off and destroyed, and all

seedling stocks dipped root and branch in a mixture of "Scalecide," one part in 20 parts of water. Moreover, the boxes, the interior of the storage house and the packing material, were all drenched with another kind of miscible oil, "Target Brand Scale Destroyer," used in the proportions of one part to about 12 parts of water. An attempt was made to burn the sphagnum packing material, but as it was wet, it was not a satisfactory treatment, and this material was then soaked with the oil preparation.

The dipped stock was pruned root and top, and some of it grafted and planted out. Though some of it failed to grow, the percentage was no greater than with some other lots of imported nursery stock not so treated.

In caterpillar time Mr. Walden made an inspection of the trees and other vegetation growing in the vicinity of the nursery and packing houses, and another examination was made in the fall, but no evidences of infestation by the brown-tail moth were found.

Some nests were found in Port Chester, N. Y., on nursery stock from Massachusetts, which was planted out on an estate only a few rods from the Connecticut line. The case was reported to us by Mr. C. T. Hotaling of Greenwich, and we at once communicated with the New York authorities. They investigated, found several caterpillars, and burned all vegetation over quite a large area. Subsequent inspections showed no traces of the presence of the insect in that locality.

The imported nursery stock was sent to nearly every state in the Union, and in some states thousands of brown-tail nests were found. It is extremely difficult for state inspectors to get track of importations except as notified by the nurserymen purchasing the stock. When asked for notice of the arrival of such stock, the customhouse officials have, in some cases, refused to give it, remarking that they were United States officials and were not obliged to take orders from state inspectors. Much of the stock, however, arrives at the port of New York, and New York state inspectors watched carefully and notified us and the inspectors of other states on the arrival of stock consigned to our respective states. In a few cases the Bureau of Entomology of the U. S. Department of Agriculture at Washington notified us of the

arrival of stock for Connecticut from foreign countries. Undoubtedly there were a number of importations entering through the port of New York of which we received no notice, as well as many shipments entering the state through other ports. This experience and the great danger of bringing serious pests into the country emphasize strongly the need of some adequate system of Government inspection, and it is hoped that some legislation along this line may be enacted by the present Congress. Most nations have systems of inspection of similar imports at the points of entry, but there has never been any provision for the Federal inspection of such stock in this country, and the only inspection that it receives is made by state officials. Some nations would have at once issued an embargo against all nursery stock entering the country from France, or even from Europe, after receiving infested shipments; but nothing of this kind was done by our Federal government.

SOURCES OF IMPORTED NURSERY STOCK.

Country.	No. of Boxes or Bales.
Belgium	2
England	16
France	71*
Germany	93†
Holland	109
Japan	6
Unknown	9
Total	306

PROVISION FOR THE INSPECTION OF APIARIES TO
SUPPRESS CONTAGIOUS DISEASES OF BEES.

A bill providing for the inspection of apiaries in Connecticut was introduced into the legislature of 1907 by the Connecticut Beekeepers' Association. Owing to the form of this bill and to the fact that the members were not united in their opinions regarding the requirements of such a law, the matter was reported unfavorably by the committee. The members of the association agitated the question, and it was suggested that the

* One shipment contained 52 nests of brown-tail moth.

† All small pine seedlings for forest planting. Only a small portion examined.

work be placed in charge of the station; a bill to that effect was therefore drawn up and introduced into the legislature of 1909. After the usual number of hearings and changes in the bill made by the committee, the following bill was passed:

AN ACT CONCERNING THE SUPPRESSION OF CONTAGIOUS DISEASES AMONG
BEES.

Chapter 185 Public Acts of 1909.

SECTION 1. *Duty of state entomologist to act on complaint.* For the purpose of suppressing contagious or infectious diseases of the honey bee, it shall be the duty of the state entomologist, when complaint is duly made, to examine and verify, and treat or destroy cases of foul brood among honey bees.

SEC. 2. *Authority to appoint inspectors and to examine apiaries.* In pursuance of the provisions of this act, the state entomologist or any person whom he may appoint for that purpose shall have access at reasonable times to such apiaries or places where bees are kept and where honey-comb and appliances are stored as may be designated in any such complaint.

SEC. 3. *Authority to make regulations.* The state entomologist is authorized and empowered to prescribe suitable forms for and make regulations regarding such complaints, and shall keep the same on file and open to public inspection; and he is further authorized and empowered to make, in his discretion, reasonable rules to govern, and reasonable payments for the services of agents whom he may appoint to carry out the provisions of this act.

SEC. 4. *Obstruction illegal. Penalty.* Any person who impedes, resists or hinders the state entomologist or any agent whom he may appoint in the performance of the duties imposed by this act shall be fined not more than twenty-five dollars.

SEC. 5. *Provision for defraying expenses.* To carry out the provisions of this act the necessary expenses, to an amount not exceeding five hundred dollars, shall be paid by the comptroller on duly accredited vouchers.

Approved August 2, 1909.

This law did not go into effect until October 1st, 1909, too late to do any work this season. On October 20th the following inspectors were appointed:

H. W. Coley, Westport—Inspector for Fairfield, New Haven, Middlesex, and New London counties.

A. W. Yates, Hartford—Inspector for Litchfield, Hartford, Tolland and Windham counties.

The appropriation for the work is very small, being only \$500 for two years. It will be impossible to cover the entire State on this amount of money, but a start can be made. As inspections can be made only on complaint, it is necessary to have complaint blanks filled out and signed. These can be sent to the office of the state entomologist or to the inspector named above under whose jurisdiction the locality may be.

Blanks for these complaints have been printed and two of them with a circular letter have been sent to each member of the Connecticut Beekeepers' Association. The form of the blank and a copy of the letter are given below:

APPLICATION FOR APIARY INSPECTION.

W. E. BRITTON, State Entomologist,
Agr. Expt. Station, New Haven, Conn.

Dear Sir:

The apiary of Mr. _____ of _____, Conn., is suspected of being infested with either American or European foul brood, and I therefore respectfully request that you have it examined under the authority given you by the Public Acts of 1909, Chapter 185.

Yours truly,

Address _____

Complainant.

OFFICE OF STATE ENTOMOLOGIST.

AGRICULTURAL EXPERIMENT STATION.

NEW HAVEN, CONN.

February 15, 1910.

TO THE BEEKEEPERS OF CONNECTICUT:

Dear Sir:

I am mailing you in this letter some blank applications for apiary inspection. After being filled out, they can be sent either to me or to the inspector of your district named below:

H. W. COLEY, Westport, Conn., inspector for Fairfield,
New Haven, Middlesex and New London counties.
A. W. YATES, Hartford, Conn., inspector for Litchfield,
Hartford, Tolland and Windham counties.

Each blank must be filled out in detail, if possible giving definite directions about the location of the apiary. It must also be signed. A man may sign an application for the inspection of his own apiary.

Please send to this office the names of all beekeepers in your locality, together with any other information, such as number of colonies in each apiary, for permanent filing to aid us in this work.

Very truly yours,

W. E. BRITTON,

State Entomologist.

Card records of the apiaries of the State (as far as the information can be secured) and all inspections of them will be kept on file in the office of the state entomologist and open to the public during office hours.

Beekeepers and others interested can aid by sending information regarding their apiaries or the names of other beekeepers.

MUNICIPAL SPRAYING OF ELM TREES IN CONNECTICUT IN 1909.

Serious injury to elm trees by the elm leaf beetle for the two seasons of 1907 and 1908 led us to expect in Connecticut an attack of extraordinary severity in 1909. The danger was further indicated by the drought of July and August, when usually many of the pupæ are killed by the white mold fungus which is prevalent in a moist season, and later by the unusually large number of adults which appeared in the spring.

Warning was therefore given in the last report and in the various lectures given by the state entomologist. Several towns and cities through their selectmen, directors of public works, park superintendents, and tree wardens, conferred with the state entomologist, who gave advice and in a number of cases visited the locality and examined the trees. There was quite a demand for illustrated lectures on the "Care and Protection of Shade Trees," and the state entomologist gave thirteen such lectures on this subject before granges, schools, village improvement and civic associations. At a town meeting in Clinton, May 19th, it was voted to appropriate \$1,000 for spraying the elm trees, there being about 800 trees of this kind along the street and highways of the town. Several other towns raised money by taxation to care for their shade trees. In some cases the town authorities purchased spraying apparatus and hired local help to do the work, while in other towns the spraying was done by contracting firms who make a specialty of such work. Where

town or city funds could not be obtained for the purpose, improvement associations raised money and hired the work done, or provided for having it done at the owner's expense where authorized to do so.

The city of New Haven let a contract to spray 7,500 elm trees in the original twelve wards, giving two sprayings at the rate of about \$1.49 per tree.

The statistics collected by this office show that over 20,000 elm street trees in the State were sprayed in 1909 and at least nearly half of these were sprayed twice. No doubt there were many others of which we received no record. In addition there were also hundreds of elm trees on private grounds that were sprayed to forestall the attacks of the beetle.

The following is a list of persons and firms known to have done commercial spraying in Connecticut in 1909 and is given here merely for the convenience of those who desire to communicate with such persons and firms for estimates and bids. It should be understood that in publishing this list the station in no way endorses or guarantees the work done by these firms. Much of it, however, is known to us and must be considered satisfactory.

LIST OF FIRMS ENGAGED IN COMMERCIAL TREE SPRAYING IN CONNECTICUT
IN 1909.

Allen, Geo. G.	New Haven, Conn.
Arnold, A. S.	Danbury, Conn.
Cornell, Joseph	Norwalk, Conn.
Dehn & Bertolf.....	Greenwich, Conn.
Frost & Bartlett Co., H. L.	Stamford, Conn.
Hazard, James O.	Westerly, R. I.
Hotaling, Chas. T.	Greenwich, Conn.
Kimball, F. L.	Norwich, Conn.
Lindeman, C. T.	R. F. D. 2, Putnam, Conn.
Mount Carmel Forest and Nursery Co..	Mount Carmel, Conn.
Munson & Whittaker Co..	Boston, Mass., and New York, N. Y.
New Haven Forestry Co..	966 Grand Ave., New Haven, Conn.
Providence Forestry Co. .	840 Chapel St., New Haven, Conn.
Purinton, C. O.	Hartford, Conn.
Shattuck & Co., Frederick B. .	Tremont Bldg., Boston, Mass.
Schoonman, W. J.	Danielson, Conn.
Schults & Co., W. F.	Hartford, Conn.
Sierman, Chas. H.	Hartford, Conn.
Smith, M. H.	Natick, Mass.

Stevens, Jr., F. V.	Stamford, Conn.
Taylor, James	Wallingford, Conn.
Withers, J. T.	1 Montgomery St., Jersey City, N. J.
Woundy, B. S.	New Canaan, Conn.

COMBATING THE GYPSY MOTH IN CONNECTICUT.

STONINGTON INFESTATION.

For previous accounts of the discovery of this pest and efforts to exterminate it at Stonington, the reader should consult the reports of this station (1905, p. 246; 1906, p. 235; 1907-08, pp. 300 and 772).

The scouting was done in the winter of 1908-09 by Mr. G. H. Hollister, who has had immediate charge of the work as local superintendent for three years, and Mr. Miller, a scout furnished by Mr. D. M. Rogers, special field agent in charge of the gypsy moth work for the Bureau of Entomology.

Only six egg-clusters were found.

Early in February, 1909, Mr. Hollister began work for H. L. Frost & Bartlett Co., pruning and spraying trees, and returned to the gypsy moth work at Stonington about July 1st. He was also able to help there for about a week early in May, while the trees were being banded with burlap. During the remainder of the time through May and June Mr. Fred Hoadley was in charge of the force.

As the result of our efforts during the three preceding years the infested area had been reduced so it was not considered necessary to band as many trees as heretofore. About 6,000 trees were banded and though a careful search was made only ninety-eight caterpillars were found. Considerable scouting was done during the caterpillar season, especially around the outside edges of the infested area. No caterpillars were found this season at Walnut Grove, though the trees were banded as usual and were faithfully watched.

Messrs. Dennis and Casey, government scouts, were sent to Stonington by Mr. Rogers, and in company with Mr. Hollister, they scouted the infested territory again during the second week in December. Only one egg-mass was found. The government scouts afterward examined the territory northeast of Stonington toward Westerly, R. I., but nothing was found.

The following figures show the results of our work at Stonington:

Date.	Egg-masses destroyed.	Caterpillars destroyed.	Cocoons destroyed.
1906.....	73	10,000	47
1907.....	188	2,936	200
1908.....	76	2,560	44
1909.....	6	98	0

It seems therefore that the gypsy moth is well under control at Stonington. Probably a few caterpillars will be found there the coming summer, and it will be necessary to repeat the work of banding the trees for at least two more seasons, and even after it is thought to be exterminated, the locality will require careful examinations annually for several years.

Mr. Hollister scouted for about two weeks in the northeastern part of the State and furnished the following notes:

"The following towns and villages were visited and sections looked over in search for any evidences of the gypsy and brown-tail moths: Putnam, Danielson, Plainfield, Dayville, Moosup, Sterling, East Killingly, Thompson and East Thompson.

The trees and bushes, and in some cases fences and buildings in the vicinity of the railroad stations, were looked over and also those near the garages.

The trees and bushes along the trolley road from Danielson to East Killingly were also scouted and those along the highway leading from Putnam north to the state line.

This scouting was done during the latter part of January, 1909. No evidence of either species of moths were found in the above-mentioned places."

WALLINGFORD INFESTATION.

Discovery of the Gypsy Moth at Wallingford. The following clipping was taken from the Wallingford news in one of the New Haven daily papers of Monday evening, December 13th, 1909:

"Warden Becroft yesterday discovered cocoons containing eggs of what he is informed are gypsy moths. They are on maple trees on North and South Colony Streets, Meadow Street and North Whittlesey Avenue. The street department will get busy to-day with a wash of creosote, and it is requested by the warden

that residents throughout the borough investigate and ascertain, if possible, if cocoons of a similar nature are to be found elsewhere. The warden claims the moths were brought here by autos passing along Colony Street."

This item was noticed by Mr. Walden, who brought it to the office the next morning and who was sent to Wallingford during the day to investigate the report. Before he could find Warden Becroft to learn the source of the report or the locality infested, Mr. Walden noticed two egg-masses on the trunks of trees on Whittlesey Avenue, and at once telephoned the news to the office, and the entomologist visited the place in the afternoon. By this time Mr. Walden had found a spot on Union Street where egg-clusters were abundant and counted nearly 300 on one tree. A large number were found on some of the maple trees along this street and on several backyard apple trees.

The presence of this pest in Wallingford was discovered by Mr. Leslie A. Brown, a designer of silverware in the factory of the R. Wallace & Sons Mfg. Co. Mr. Brown lives at 179 Christian Street, near the corner of Main, and in traveling to his work takes a diagonal route toward the factory, crossing Whittlesey Avenue, Orchard and William streets, through Meadow to Church and Colony and thence down Quinnipiac Street to the factory. It was on Meadow Street near Church where Mr. Brown noticed a cluster of eggs on the trunks of a maple tree one morning on his way to work. The next morning he saw several other egg-clusters in the vicinity and informed Mr. William E. Becroft, the warden of the borough.

Mr. Brown formerly lived in Newburyport, Mass., and moved to Wallingford in October, 1908. He had seen the gypsy moth at his old home in Waltham, Mass., and was thus able to recognize the egg-clusters when he saw them in Wallingford, though he had passed the trees a great many times without noticing them.

Mr. Becroft then looked about and saw a few egg-clusters on each of the several streets in that vicinity and noticed some not far from his own house on North Whittlesey Avenue. The worst infested spots, however, had escaped notice until discovered by Mr. Walden.

Destroying Egg-Masses. The next day (December 15th) we had men at work soaking these egg-clusters with creosote oil

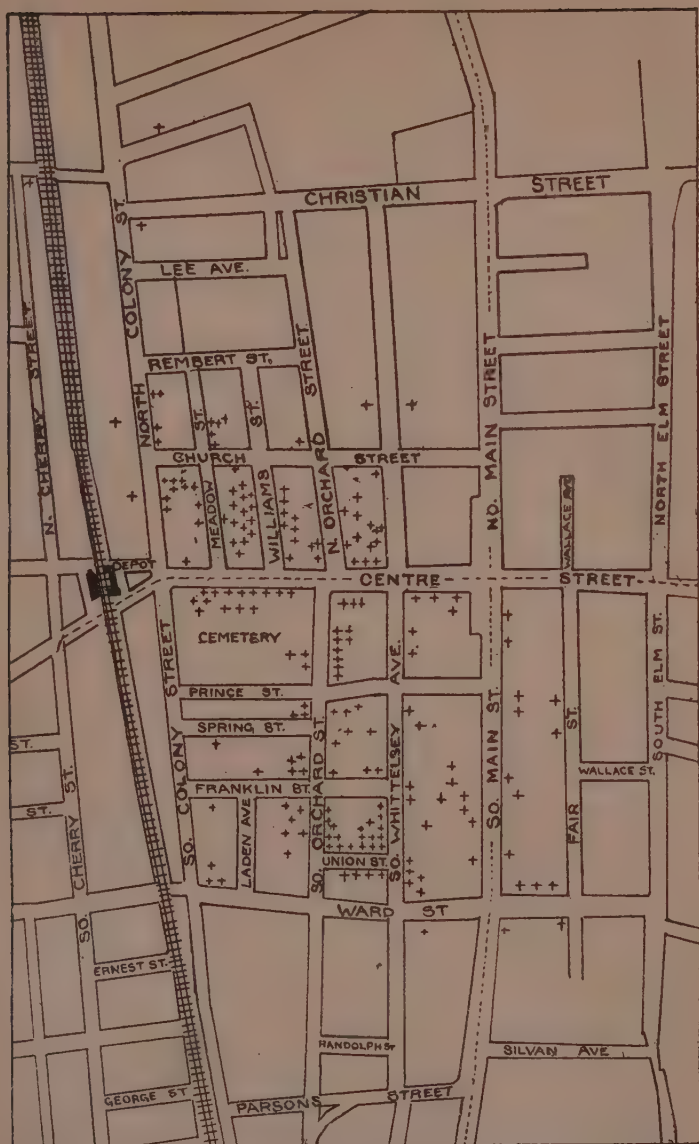


Fig. 1. Map of Wallingford, showing the region infested by the Gypsy Moth. The check marks show where egg-clusters were found during the winter of 1909-10.

to prevent their hatching if broken open and the eggs scattered. Warden Becroft furnished one man, who was used to climbing, and who worked the remainder of the week with Mr. Graham and Mr. Walden, the latter being in charge.

The following week Mr. Hollister, who had been scouting in Stonington, worked for five days at Wallingford in scouting and destroying egg-masses. Back of the stores on Center Street, between Meadow and William streets, was a bad center of infestation which now appears to have been the original one, from which the pest may have been carried to the vicinity of Union Street on rubbish placed on the Whittlesey Avenue dump. A heavy snowstorm on Christmas day preventing further scouting work, but up to this time nearly 6,000 egg-clusters had been found and destroyed.

Educational Work in Wallingford. Some of the gypsy moth cards issued three years ago were distributed by Warden Becroft in store windows and other conspicuous places around Wallingford. On February 7th, seventy-five of these cards were sent by request to Mr. Marsh, superintendent of schools, who agreed to place one in each schoolroom in town.

Life history sets of the gypsy moth in Riker mounts, $6\frac{1}{2} \times 8\frac{1}{2}$ inches in size, were prepared and five (one for each building) furnished to the schools. One was placed on exhibition in the public library.

On December 23d, the state entomologist, Dr. Britton, gave an illustrated lecture on the gypsy moth before the Wallingford Grange, showing a number of local views. Dr. Jenkins was also present, and spoke briefly regarding local conditions. The meeting was an open one, to which the public had been invited. Nearly one hundred persons were present, some of whom were not members of the Grange.

On January 3d, Dr. Jenkins lectured before the Ladies' Aid Society in the public library and referred to the gypsy moth infestation in Wallingford and to the local conditions.

On February 1st, Dr. Britton lectured to the teachers and pupils of the Wallingford public schools, showing lantern slides.

Warning Notices Scattered Over the State. The coöperation of the New York, New Haven & Hartford Railroad Company was sought and permission received to post warning notices in the waiting-rooms of the railroad stations throughout the State.

A new and revised edition was printed of the cards issued three years ago and a copy was sent January 13th to each station agent of the road in Connecticut. The railroad company kindly

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

SPECIAL BULLETIN



FEMALE MOTH



CHRYSAIDS or PUPA



MALE MOTH



THE GYPSY MOTH
Portethia dispar. Linn

A DESTRUCTIVE PEST OF ALL VEGETATION

(These illustrations are natural size)

WARNING!



EGG-MASS ON DARK



CATERPILLAR

The caterpillars devour the foliage of fruit, shade and forest trees, including coniferous trees, often killing them. Other kinds of vegetation are also attacked. It has done incalculable damage in Massachusetts during the last twenty years. A small colony was discovered in Stonington, Conn., in 1906, which by careful work has been nearly exterminated. In December, 1909, a large infestation was found in the village of Wallingford, and vigorous action is now being taken against it. Eggs hatch about May 1st, and the caterpillars feed upon the trees until July. When young, they descend upon threads, and may be carried to new places by trains, carriages, automobiles, or any passing vehicle. When nearly mature the caterpillars feed at night, hide under rubbish during the day, and crawl about in going from tree to tree. Chrysalids may be found under fence rails and in holes in trees. The adults appear late in July, the male flying by day, and the female resting on the trunks of trees. The eggs are laid on trees, usually on the trunks or under side of the large branches.

Destroy eggs by soaking egg-masses with creosote oil.
Band trees with burlap, and crush caterpillars found under the bands in June.
Spray the foliage with arsenate of lead (5 lbs. in 50 gallons of water).
It is a violation of the law to transport living specimens.
Persons finding insects or egg-masses resembling the gypsy moth are asked to kill the specimens by dropping them into alcohol or gasoline, and send them for identification to

W. E. BRITTON, State Entomologist
Agricultural Experiment Station New Haven, Conn.

Fig. 2. Facsimile of warning notice posted throughout the State.

furnished a list of the addresses of the station agents, and also issued orders to them that the cards be posted in the stations. Similar arrangements were made by the Central Vermont Railroad Company, and cards have now been posted in all railroad

stations in Connecticut. Cards were also mailed to all postmasters in the State, with a request that each card be put in a conspicuous place, and to the secretaries of all granges in the State.

How Did the Pest Reach Wallingford? This question cannot be answered, because we have no direct knowledge and can only give what seems to be the most plausible explanation of it. As the area back of the stores on Center Street, between Meadow and William streets, was by far the worst infested section, it was probably the starting point of the infestation. As these stores are constantly receiving goods from manufacturers and dealers in the infested region of Massachusetts, it is not improbable that an egg-cluster was brought on a crate or packing box and left in the rear of one of the stores. Possibly some family may have moved from eastern Massachusetts into one of the houses nearby, bringing unwittingly and unnoticed an egg-mass upon the packing cases or garden utensils.

The Whittlesey Avenue and Union Street infestations are quite near the spot where rubbish is dumped on South Whittlesey Avenue and may be explained, we think, by its presence.

From the size and appearance of the Wallingford infestation and the abundance of the egg-clusters, it is probable that the gypsy moth has been there at least four years, but how it could have escaped detection for so long when so abundant is hard to understand.

Up to March 1st, about 7,500 egg-clusters had been found and destroyed.

Organization and Progress of the Suppression Work. Mr. Donald J. Caffrey, a graduate of the Massachusetts Agricultural College, has been secured as local superintendent in charge of the work. Mr. Caffrey began his duties in Wallingford January 24th, 1910, and at this writing has four men under him. With what local help and coöperation he can obtain from the property owners and borough officials, the trees in the infested section will be pruned, scraped and the cavities filled or tinned over, and some of the fences, outhouses and chicken coops overhauled before the eggs hatch May 1st. In order to do effective work it will be necessary to spray most or all of the trees, shrubs and hedges in this section after the leaves appear. For this purpose a mixture of lead arsenate will be used. The spruce

• hedge around the cemetery is infested and will need to be thoroughly treated with lead arsenate and tree tanglefoot. All trees within this infested area will be banded with burlap next season, and in order to care for the work in a proper and effective manner, men must be kept at work until the middle of August or first of September.

The illustrations accompanying this report, Plates II-XI, show much better than any verbal description, the conditions of the infested region.

Mr. Dexter M. Rogers, special field agent of the Bureau of Entomology, in charge of gypsy moth work, with headquarters at Boston, was informed of this newly-discovered infestation, and visited it on December 20th, in company with Drs. Jenkins and Britton. Mr. Rogers expressed a willingness to coöperate in the suppression work, and we requested him to send scouts to help us examine the region around the village. On February 9th he brought three men, who are now at work.

It is too early to make any definite statements regarding the limits of the infestation, but no egg-clusters have been found outside of the village and nearly all of those destroyed were found between the railroad and Main Street and between Ward Street on the south and Christian Street on the north. Several egg-clusters were found east of Main Street near Ward.

Every effort will be made to exterminate the Wallingford gypsy moth colony. This is the farthest west of any existing infestation and if it is not suppressed will be a constant menace not only to the whole State of Connecticut but to New York and New Jersey as well.

THE ROSY APPLE APHIS.

Aphis sorbi Kalt.

Aphis pyri Boyer.

Aphis malifoliae Fitch.

Though the season of 1909 was especially an aphid year and nearly all kinds of plant lice were abundant, the kind that probably caused more damage than any other is a pinkish or purplish species found on the fruit spurs of apple trees and called the rosy apple aphis. This species has of course been present in Connecticut for a long time, though there are few

records. I have observed it in a number of different localities during the past sixteen years; but apparently it did little damage and scant attention was paid to it. In 1908, however, it was brought to my attention in the orchard of Mr. E. M. Ives of Meriden, and it was chiefly there that these studies were made, some of the work being done by Mr. Arthur I. Bourne between June 24th, when he entered the employ of this office, and November 18th.

During 1909 it was much more serious than in the preceding year and caused great damage to apples—not only to the season's crop of fruit but to the trees as well.

Specimens were received from Putnam, Manchester, Wallingford, West Haven and Stratford, and the insect was observed at several other places.

DIFFERENCE BETWEEN THE GREEN AND ROSY APPLE APHIDS.

The most troublesome plant lice on apple in Connecticut are the green apple aphid, *A. pomi* De Geer, and the rosy apple aphid, the identity of which seems not to have been well established. For instance, we find accounts of apparently the same insect as *Aphis sorbi* Kalt., as *Aphis pyri* Boyer., and as *Aphis malifoliae* Fitch. The green apple aphid was described briefly and figured in the report of this station for 1903, page 259. It attacks the terminal shoots and tender leaves, causing the leaves to curl. It affects the tree chiefly by restricting the growth and is much more serious on young orchard trees and nursery stock than upon old trees. All stages are bright green except the oval egg, which is green when first laid but soon turns to a shining black. Eggs are laid on the terminal twigs late in the season and are conspicuous and often abundant. The rosy apple aphid is pink or purplish in color and seems especially prone to attack the fruit spurs and the inner portions of the tree top rather than the terminal twigs and exterior part. The eggs are smaller and much less conspicuous than those of the green apple aphid, and one often needs to hunt carefully in order to find them at all, as they are hidden around the buds, sometimes partly under the scales.

The attacks of the rosy apple aphid affects seriously the fruit and prevents its growth and development, causes it to be gnarled

and irregular in shape. The leaves curl early and often turn yellow and fall late in June if badly infested.

The green apple aphid remains on the apple leaves and shoots throughout the season, but the rosy apple aphid leaves the apple and goes to some other unknown plant host—during the latter part of June—returning to the apple in October and later laying eggs to carry the species through the winter.

LIFE HISTORY.

The eggs of the rosy apple aphid hatch about the middle of April just as the green leaves begin to show at the ends of the buds. On April 16th, in Mr. Ives's orchard at Meriden, the aphids were hatching and the buds had opened just enough to show the green tissue. Many newly-hatched aphids could be seen on the opening buds, though many eggs were still unhatched.

These aphids were abundant through blossoming time and were thick on the young fruit. During the latter part of June, or about the first of July, they disappeared entirely from the trees and did not return again until October.

On November 12th, 1909, the aphids were laying eggs, though but a few could be found.

DESCRIPTION.

The following description and measurements were made by Mr. Bourne:

1st Stage. Color is an almost transparent white when just born, rapidly changing to a cream white as they begin to feed. Eyes are very conspicuous—deep red. Body nearly oval. Posterior end of abdomen bluntly pointed. Antennæ almost equaling length of body, 5-jointed; 3d and 5th joints much the longest. Joints 1 and 2 hardly longer than wide. Antennæ remote at base, no frontal tubercles. Head, broad, flat in front between bases of antennæ. No noticeable lines of division into the three body regions. Legs, long in proportion to size of body. Tarsi and joints of tibiæ, dusky. Beak, long, slender, reaching beyond the 3d coxæ. Cornicles, short, scarcely more than tubercles, not longer than 1st segment of abdomen. Wider at base than tips. Cut off square at ends. Straight. No cauda noticeable in this stage.

2d Stage. Almost twice as large as 1st stage. Color, a deeper yellow. Eyes very deep red. Much more developed than in preceding stage. Body, very convex, almost oval. Head, flat in front. No constriction back of eyes. A very short tubercle, hardly more than a ridge, on each margin of prothorax just back of eyes. Antennæ, 6-jointed. Outer joint the longest and dusky. Do not reach quite to base of cornicles. Tarsi and joints of tibiæ and last joint of beak, dusky. Cornicles equal in length two segments of abdomen. Straight, somewhat tapering and tips flaring a little and quite dark. Legs are not so large in proportion to size of body as in 1st stage. Tibiæ are distinctly hairy, especially toward tip.

3d Stage. (Form that will be wingless.)

Color, brick red. More noticeable along dorsal portion of head, thorax and margin of abdomen. Body, much more convex and considerably larger than preceding stage. Tips of antennæ, joints of tibiæ, whole of tarsi, tips of cornicles and of rostrum, a dusky color. Antennæ, 7-jointed, reaching back beyond the base of cornicles; 3d and 7th joints nearly the same length. Head, narrowed slightly in front, back of eyes broadens considerably. Eyes dark red, almost black, with a prominent ocular tubercle and prominent tubercles on prothorax. Each segment of abdomen with a tubercle on margins. Cornicles, of medium length, straight, tapering slightly, quite slender, ends flaring. Dorsal portion of abdomen, a faint greenish yellow. Can begin to distinguish the embryos forming within. Legs of medium length, with distal ends of tibiæ covered with long bristly hairs, as is the very tip of abdomen. Beak, quite long and slender, reaching a little beyond 3d coxæ.

3d Stage. (Winged form.)

Body, some longer and of about same width as other form. The color is paler somewhat than in wingless form. More of a yellowish tinge, especially near dorsal portion of abdomen. Tips of antennæ, cornicles, tibiæ and beak and whole of tarsi, dusky. Eyes, dark red, as in other form. Antennæ, 7-jointed, not quite reaching base of cornicles. Legs, only moderately long. Cornicles, rather short and thick. Slightly tapering. Ends cut off square on 2d segment of abdomen in front of cauda. Two short blunt tubercles, and on the last two segments of thorax are a pair of wing pads, giving the appearance of shoulders to the insect. Ocular tubercle very prominent. Short blunt tubercle

on each segment of abdomen on margins. Beak, slender, reaching to posterior coxæ.

4th Stage. (Winged.) Brick red, most pronounced on head and thorax. End of abdomen, wing cases, antennæ, legs and beak, yellowish. Tips of antennæ and beak, cornicles and tarsi, dusky. Body is somewhat covered with a powdery substance. Is more elongated than oval. Cornicles, straight, wider at base than tips. Tips flaring. Not reaching to the end of the abdomen. Cauda, none or inconspicuous. Abdomen, tipped with a few long hairs. Antennæ, reaching but little beyond middle of abdomen. Eyes, very dark red. Ocular tubercles present, not as prominent as in wingless form. Head constricted somewhat just behind the eyes. Prothorax with two prominent lateral tubercles. Two pairs of wing cases very prominent. Front pair much longer than hind pair. On abdomen, the two segments from end each bear a pair of tubercles. The outer pair small, set nearer together. Tips, dark. Short. A tubercle on each segment of abdomen on outer margin. Embryos can be plainly seen through the dorsal portion of abdomen. Beak, slender, reaches almost to posterior coxæ.

4th Stage. (Wingless.)

Color, same as in winged form. Brick red on head, thorax and margin of abdomen. On dorsal portion of abdomen color is changed from red to orange and yellow, and the embryos can be seen within. Antennæ, tibiæ, cornicles and beak with thin tips, dusky. Cauda, inconspicuous. Two pairs of tubercles on segment before tip of abdomen, as in other forms of the same stage. Each segment of abdomen with a short tubercle on each margin. Abdomen, very convex, almost as broad as long. Prothorax, with two prominent tubercles. Tibiæ, distinctly hairy. Head, narrower in front than back of antennæ. Eyes, very dark red. Ocular tubercle, prominent. Beak, only moderately long, not reaching much beyond 2d coxæ. Antennæ, almost reaching to bases of cornicles, 7th joint longest. Considerably smaller than adult and not nearly so convex even in proportion to length. Body, sometimes covered over with powdery substance.

Adult. (Wingless.)

Color, head, thorax and margin of abdomen dark reddish brown. Quite dark and usually covered with a powdery substance which gives the insect a deep blue color. Along the top

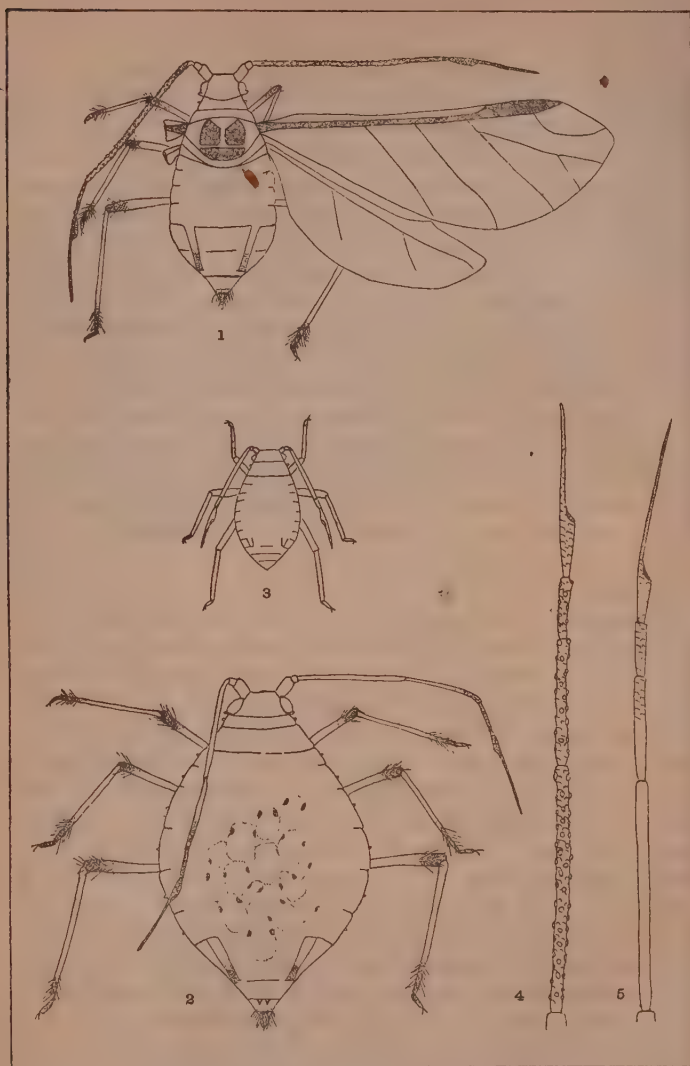


Fig. 3. Rosy Apple Aphis. 1, winged viviparous female ; 2, apterous viviparous female ; 3, young nymph ; 4, antenna of winged viviparous female ; 5, antenna of apterous viviparous female. All greatly enlarged.

of abdomen the color fades to a lighter yellow and the embryos within give a greenish tinge to the abdomen. Legs, white, except tips of tarsi and tibiae, which are dusky. Beak tipped with black. Cornicles, pale greenish yellow tipped with black. Antennae, almost transparent, except tips, which are dusky. Eyes, reddish black. Head, narrow in proportion to rest of body. Antennae set wide apart and fixed directly to the head. A short tubercle midway between bases of antennae in front. Ocelli present. Ocular tubercles, not very conspicuous. Antennae, 7-jointed. 3d longer than other joints. Reaches a little over half the length of the abdomen to bases of cornicles. Beak, slender, reaching halfway between middle and posterior coxae. Prothorax, with two prominent tubercles. On other segments there are a pair of blunt tubercles, hardly more than ridges, the 2d pair being the more prominent. Legs, long and to some extent hairy. Abdomen, with short blunt tubercles on outer margins of each segment. Along the dorsal portion the eyes of the embryos within are very conspicuous. Cornicles, moderately long, tapering slightly. Ends flaring, do not reach quite to end of body. Cauda, small, not very conspicuous. Hairy. On the two segments in front of cauda are two pairs of small tubercles, the pair next to cauda being the smaller and closer together.

Adult. (Winged.)

Head, dull black. Eyes, black. Ocular tubercles prominent. Antennae dusky, except very tips, which are almost transparent. Seven joints; 1st and 2d short and thick; 3d and 4th very thickly set with sensoria. No frontal tubercles. Reach almost the length of body. Beak, rather short, not quite reaching middle coxae. Thorax, 1st segment, yellowish red with prominent lateral tubercles. Meso and meta thorax, dusky, almost black. Bases of wings a somewhat lighter shade. Legs, distinctly hairy, moderately long. Outer tips of femora, tibiae and whole of tarsi, dusky. Abdomen, yellowish, almost orange. Lighter along dorsal portion than on margins. Embryos plainly seen. Give a faint greenish tinge to the dorsal portion of abdomen. The margins of each segment with a short blunt tubercle. Cauda, short, not prominent. Tipped with black. Two pairs of tubercles on two segments just in front of cauda, the posterior tubercles being smaller and nearer together. Cornicles, moderately long, tapering somewhat, with their ends flaring. Wings

TABLE I.—ROSY APPLE APHIS. MEASUREMENTS.

STAGE.	BODY.		CORNICLES.	ANTENNAE.							TIBIAE.		
	Length.	Breadth.		Total.	3d joint.	4th joint.	5th joint.	6th joint.	7th joint.	1st joint.	2d joint.	3d joint.	
1st -----	.968mm	.54 mm	.09 mm	.66 mm	.23 mm	.07 mm	.25 mm	-----	-----	.268 mm	.306 mm	.36 mm	
2d -----	1.36 "	.738 "	.144 "	.81 "	.23 "	.108 "	.07 "	.27 mm	-----	.324 "	.342 "	.432 "	
3d (wingless)---	1.7 "	1.00 "	.216 "	1.38 "	.324 "	.234 "	.18 "	.108 "	.378 mm	.358 "	.376 "	.756 "	
3d (winged) ----	1.72 "	1.02 "	.216 "	1.17 "	.216 "	.196 "	.104 "	.09 "	.378 "	.432 "	.45 "	.63 "	
4th (wingless)---	2.07 "	1.18 "	.288 "	1.4 "	.396 "	.27 "	.162 "	.108 "	.432 "	.612 "	.648 "	.811 "	
4th (winged) ----	2.28 "	1.2 "	.36 "	1.5 "	.396 "	.288 "	.180 "	.108 "	.45 "	.63 "	.684 "	.9 "	
Adult (wingless)	2.73 "	1.45 "	.36 "	1.78 "	.486 "	.342 "	.198 "	.108 "	.474 "	.738 "	.774 "	1.008 "	
Adult (winged) -	2.5 "	1.08 "	.33 "	2.37 "	.702 "	.45 "	.27 "	.108 "	.630 "	1.06 "	.974 "	1.27 "	

Adult (winged)—Wing expanse 5.4^{mm}.

with 3d discoidal vein having first branch arising at point about half its length; 2d branch nearer apex of wing than base of vein. Stigma quite long, narrow, and pointed sharply at outer end.

PARASITES OF ROSY APPLE APHIS.

The rosy apple aphid was highly parasitized in Connecticut in 1909. The illustration on Plate XIII, b, shows the appearance of the parasitized individuals on a single leaf. They were very much swollen and brown in color. The most important parasite of the rosy apple aphid in Connecticut in 1909 proved to be *Megorismus fletcheri* Cwfd.

Sanderson bred *Lysiphlebus cucurbitaphidis* Ashm. and *L. myzi* Ashm. from parasitized individuals of this aphid in Delaware* and mentions the predaceous insects *Chilocorus bivulnerus* Muls., *Prionidus cristatus* Linn and *Leucospis nigricornis* Egger as feeding upon it.

OTHER HOST PLANT STILL UNKNOWN.

Mr. Bourne spent considerable time searching the wild and cultivated plants of the fields and roadsides during the summer to ascertain the other host-plant of the rosy apple aphid, which had almost entirely disappeared from the apple trees by the middle of July. Several times Mr. Bourne examined all common shrubs, weeds and grasses growing in the vicinity of the orchard, particularly in the direction of the prevailing winds, but could not obtain even a trace of the intermediate host-plant of the aphid.

REMEDIAL TREATMENT.

On April 16th, three apple trees at Mr. Ives's were sprayed with Rex lime and sulphur wash, two with a dilution of one part to nine parts of water and the other at the rate of one to twelve. At the time of this treatment the eggs were hatching and many young aphids could be seen on the opening buds. There were, however, plenty of unhatched eggs.

Nearby trees which Mr. Ives had sprayed with a mixture sold as Cooper's V₁, one part to 100 parts of water, showed hatched aphids.

The practical value of these tests was not demonstrated, probably on account of the few trees treated and the nearness of

* 12th Rept. Del. Agr. Expt. Sta., 1900, p. 190.

the untreated trees. Even if the eggs had all been killed, which was hardly possible, reinfection from adjacent trees would be extremely easy.

Gillette states* that lime and sulphur mixtures are among the substances most effective in destroying eggs of the green apple aphid in Colorado, and Hodgkiss reached similar results with his tests on eggs of various species of aphids in New York.†

Tests were made with kerosene emulsion in different dilutions late in June to determine the proper strength to use. The emulsion standard was prepared after the formula printed on the spray calendar and is as follows:

Kerosene Emulsion.

2 gals. kerosene.

½ lb. common soap.

1 gal. water.

Dissolve the soap in hot water, add the kerosene, and churn together until a white creamy mass is formed which thickens on cooling.

Used this emulsion June 29th at the rate of one part to six parts of water and of one part to nine parts of water. Into the diluted emulsion were dipped typical infested branches. Fourteen trees scattered throughout the orchard were included in this test and both trees and their dipped branches were marked.

The dilute emulsion killed the aphids quickly when brought in direct contact with them. This could be done by dipping the branches, but would not be accomplished so successfully by spraying on account of the curled leaves.

As the winter eggs are so scarce and as the aphids multiply with such rapidity during May and June, it is a question whether any treatment aimed at the destruction of the eggs will prove wholly successful in an aphid season. We expect to make further tests in 1910 to determine this point.

LITERATURE.

- 1900, Sanderson *Myzus*, Bur. of Ent. Bull. 26, N. S., p. 68.
 1901, Sanderson, 12th Rept. Del. Agr. Expt. Sta., p. 189.
 1902, Sanderson, 13th Rept. Del. Agr. Expt. Sta., p. 149.
 1908, Gillette & Taylor, Bull. 133, Col. Agr. Expt. Sta., p. 31.
 1910, Britton, Rept. Conn. Pom. Soc., p. 145.

* Bull. 133, Col. Agr. Expt. Station, p. 27, 1908.

† Bur. Ent. Bull. 67, p. 29, 1907.

THE BUD MOTH.

Tmetocera ocellana Schiff.

For two or three seasons apple trees in certain portions of Connecticut have been seriously injured by a small lepidopterous larva that feeds upon the opening leaves, often curling them and fastening them together. In Stonington, especially, this injury was important and of a serious nature. It was observed in New Haven, Meriden, and in many other places, but in no place was the apparent damage as great as in Stonington.

The insect causing this trouble was not known at first, but was supposed to be the apple leaf-folder *Ancylus nubeculana* Clem., and the injury was mentioned in a brief note in the last report.* Felt records *A. nubeculana*† as being unusually common and causing some injury in New York State in 1907.

From pupæ reared from the curled leaves in 1909 a few small moths emerged and it proved to be the bud moth *Tmetocera ocellana* Schiff., a well-known apple pest.

The appearance of the opening leaves attacked by the bud moth is shown on Plate XIV, and the caterpillar is also shown considerably enlarged. The apple crop is often ruined because these caterpillars attack the cluster buds and eat out the undeveloped flowers where later the fruit sets. The insect also attacks nearly all other kinds of fruit trees, and feeds upon their buds.

ORIGIN, DISTRIBUTION AND PAST RECORD.

The bud-moth was long known in Europe before it was discovered in this country and probably is a European species. In 1840 it caused considerable damage in Europe and in the following year it was first observed in this country in Massachusetts, where by 1869 it had assumed the importance of an apple pest second only to the canker worm. Records show the occurrence of the insect in Pennsylvania in 1870, New York in 1880, and Nova Scotia in 1885.

Considerable damage is recorded at Rochester, N. Y., in 1887, and in Maine in 1888 and 1890. It was exceedingly injurious

* Report of this station for 1907-1908, p. 847.

† Report, New York State Entomologist for 1907, p. 28.

throughout the northeastern states in 1891 and in Michigan in 1892. The species is now found in Oregon and Idaho, and throughout the northeastern and middle Atlantic states and as far south as Washington, D. C.

GENERAL APPEARANCE.

Caterpillar.

In June when the caterpillars are full-grown they are nearly half an inch long and a light chestnut brown color, with head, legs and thoracic shields dark brown or black, smooth and shiny. The body is furnished with five pairs of pro-legs and each segment bears several rather long light-colored hairs.

Chrysalis.

This stage follows the caterpillar stage and is the period of greatest change, though quiescent. The mature caterpillar makes a nest in a tube of dead leaves and there transforms to the chrysalis or pupa, which is slightly more than a quarter of an inch in length and of a light-brown color.

Moth.

The adult is a small moth having a wing-spread of about five-eighths of an inch, with general color of dark ash-grey, with



Fig. 4. The Bud Moth. Twice natural size.

broad yellowish cross bands on the front wings and is shown in Figure 4.

Egg.

The egg is disc-like, much flattened, sometimes nearly circular, though usually oval in shape, and is laid upon the underside of a leaf, singly or in small clusters. The eggs are transparent and resemble minute drops of water.

LIFE HISTORY.

In the northern part of its range and probably in Connecticut there is but one brood each season and the insect passes the winter as a half-grown caterpillar hidden in a silken case attached to the twigs. These cases are made early in the fall, sometimes

even in August, though many of the caterpillars continue to feed until October. In the spring the caterpillars appear at the time the buds open, varying with the forwardness of the season, from April 15th to May 15th, and feed on the tender leaves and buds as described above. The leaves are tied together, forming a nest in which the caterpillar lives and feeds. Thus not only are the leaves devoured but the floral organs before developing also are destroyed, thus preventing the tree from fruiting. After feeding for six or seven weeks the caterpillar forms its cocoon and remains in it for about ten days, when the adult moth emerges. Reared specimens emerged in our breeding cages June 10th, and on this date nearly all caterpillars had disappeared. The adults probably live about two or three weeks, during which time they mate and lay eggs for the succeeding generation.

REMEDIES.

Most writers regard the bud moth as a difficult insect to control and state that the various sprays are unsatisfactory. Our experience at Stonington, however, where many apple trees infested with the bud moth were sprayed with lead arsenate, 1 pound to 10 gallons of water, in the attempt to control the gypsy moth, indicate that this poison will also control the bud moth. Of course the application should be made early—before the blossoms open, and should be repeated after they have fallen. Slingerland advises* two thorough applications before the flowers open. For this purpose lead arsenate is preferable to Paris green.

Where orchards are properly sprayed with arsenical poisons to forestall damage by canker worms, codling moth, tent-caterpillar and other biting insects, there will usually be less trouble from the bud moth, but any efforts in this direction must be thorough and persistent in order to succeed.

LITERATURE.

- 1888, Harvey, Report Maine Agr. Expt. Sta., p. 169.
- 1890, Harvey, Report Maine Agr. Expt. Sta., p. 128.
- 1893, Slingerland, Cornell Univ. Agr. Expt. Sta. Bull. 50.
- 1896, Slingerland, Cornell Univ. Agr. Expt. Sta. Bull. 107, p. 57.
- 1897, Lowe, New York (Geneva) Agr. Expt. Sta. Bull. 136, p. 597.
- 1897, Cordley, Oregon Agr. Expt. Sta. Bull. 45, p. 118.
- 1903, Cooley, Montana Agr. Expt. Sta. Bull. 51, p. 201.

* Cornell Univ. Agr. Expt. Sta. Bull. 107, p. 65.

THE LEOPARD MOTH.

Zeuzera pyrina Linn.

A brief note was printed in the last report of this station (1907-1908, page 847) regarding the occurrence of the leopard moth in Connecticut. Since this note was published considerable evidence has been brought to our attention of serious damage to shade trees, especially elms, by this insect. Pruning of the trees and especially the removal of dead branches reveals the tunnels of the leopard moth larva, which is a borer in the branches and trunks of many species of broad-leaved trees. The illustration on Plate XVI, a, shows one of these galleries, and the infested branch was taken from one of the large elm trees on the New Haven Green. Several specimens of the adult moths have been captured in New Haven, but it was not known until recently that the insect is doing much injury to the trees in Connecticut.

DISTRIBUTION AND SPREAD IN AMERICA.

The leopard moth is a European pest, and like many other very injurious insects that we now have to fight, was accidentally introduced into this country, being first noticed in June, 1881, at Hoboken, N. J. Three years later Dr. E. B. Southwick found it injuring trees in Central Park, New York City, and in 1894 pronounced it one of the worst insect pests attacking shade trees. The leopard moth was soon found in other cities near New York and in 1907 Mr. A. H. Kirkland, then superintendent in charge of the work of suppressing the gypsy and browntail moths in Massachusetts, called attention to its presence in Boston. During 1909, the writer was informed of its occurrence in Providence, R. I., and also that many of the fine elms of Cambridge, Mass., were threatened with destruction by this insect. The leopard moth is reported by Professor Smith* as occurring as far south as Long Branch, N. J. As it first appeared in Hoboken, N. J., it will be seen that like many other European insects introduced into this country it has spread northward much more rapidly than in any other direction.

* Report N. J. Agr. Expt. Sta. for 1908, p. 315.

TREES AND SHRUBS ATTACKED.

Over eighty species of trees and shrubs have been recorded as being attacked by the leopard moth, and some of them greatly injured. The list includes maples, elms, horse chestnuts, beeches, birches, dogwoods, hickories, oaks and walnuts, their susceptibility being indicated by the order in which they are named. Elms and maples are evidently most commonly attacked from the reports from different cities, but it should be borne in mind that in the Eastern States these trees are far more abundantly planted, both as street trees and as shade trees on private places, than any other kinds of trees. In Central Park, New York City, nearly all deciduous trees and shrubs were to some extent injured by the leopard moth.

APPEARANCE OF INFESTED TREES.

Infested small branches frequently wither and die in mid-summer. Sometimes these will break off, but more often remain, showing as dead twigs above the green foliage. Large scars on the major branches or trunk are caused by the larger caterpillars.

LIFE HISTORY AND HABITS.

The female is said to lay eggs in the crevices of the bark of the trunk and branches, and as adult moths are taken from early June to late in September this may properly be regarded as the egg-laying season of the insect. In capacity the moths have laid as many as 300 eggs each, and some writers estimate that many more up to 1,000 may be deposited. The young borers often enter the twigs at the base of a bud, then tunnel along the pith, though in some places the burrow curves outward to the bark. Holes through the bark are made here and there for disposing of the chips, which serve to show where the borers are at work.

The early-hatched caterpillars reach a length of about an inch by the end of the season and have the habit of leaving their burrows, crawling about on the branches of the tree to seek another point of attack, perhaps in a larger branch. Such branches are sometimes nearly girdled by the tunnels, and die or break off at the point of injury. The illustration on Plate XVI, a, shows the chamber where two galleries intersected. Most

writers state that two years are required for the leopard moth to pass from the egg to the adult stage, and the caterpillar transforms to the pupa inside the burrow at a point where the bark has previously been eaten through. The pupa by wriggling is able to work itself partly out of the branch, when the skin splits open and the moth emerges, leaving the empty pupa case protruding from the orifice of the burrow.

The leopard moth appears to confine its attack to the trees of cities and towns and does not cause much damage to trees growing in country districts.

APPEARANCE OF THE INSECT.

The moths are dirty white and semi-transparent, with a yellow or brownish front margin to the wings, marked as shown in



Fig. 5. Female Leopard Moth. Natural size.

the accompanying figure (Fig. 5) with metallic blue dots. The female has a wing-spread of from two and one-half to three inches, and that of the male is about one and three-fourths inches. The markings of the two sexes are similar, except that the dots are more pronounced and the colors brighter in the female.

The eggs are about the size of a pin head and are orange yellow in color.

The caterpillar is pinkish, flesh-colored or dirty white, with a number of dark spots or tubercles, the latter bearing short hairs. Head, thoracic, and anal shields dark brown. Length about two inches.

REMEDIES.

The position of the caterpillars tunneling in the branches, especially when they are in the tops of large trees, render them exceedingly difficult to reach. If the trees are pruned or other-

wise gone over systematically every year or two the burrows will certainly be detected and can be treated by injecting a few drops of carbon disulphide from an oil can into each and closing the opening with clay, putty, grafting wax or newly-made hard soap. The poisonous fumes penetrate throughout the galleries and will kill the borers therein.

Wilting branches indicate the presence of the borers and should be removed and destroyed. All twigs and limbs that break off during storms should be gathered and burned, thus destroying many of the borers in their tunnels. All female moths should be destroyed wherever found.

LITERATURE.

- 1882, Doll, *Papilio*, vol. ii, p. 34.
 1890, Machesney, *Entomologica Americana*, vol. vi, p. 31.
 1890, Smith, *Garden and Forest*, vol. iii, p. 30.
 1892, Pike, *Insect Life*, vol. iv, p. 317, fig. 56.
 1893, Lintner, *Ninth Report*, N. Y. State Entomologist, p. 246.
 1894, Southwick, *Insect Life*, vol. vii, p. 138.
 1905, Felt, *Insects Affecting Park and Woodland Trees*, vol. i, p. 75, pl. 4.
 1905, Smith, *Bull. 181*, New Jersey Agr. Expt. Sta., p. 29.
 1909, Smith, *Report New Jersey Agr. Expt. Sta. for 1908*, p. 315.
 1909, Britton, *Report Conn. Agr. Expt. Sta. for 1907*, p. 847.

THE PEACH BORER.

Sanminoidea exitiosa Say.

Next to the San José scale the peach borer is probably the most serious insect enemy of the peach in Connecticut. It is found in the United States east of the Rocky Mountains and Canada. It is an American insect and though the peach is not native to America it seems to feed upon it in preference to other hosts.

The Connecticut orchardist therefore is obliged to wage constant and systematic warfare against the peach borer in order to save his trees from destruction, and this brief article is here printed for the benefit of those who are not yet familiar with the work and appearance of the insect and the methods of controlling it.

EFFECT UPON TREES.

Peach trees infested with borers have a sickly appearance, with light green or yellowish foliage, and the uninitiated often

mistake the trouble for an obscure disease of the peach called "Yellows." There is no connection, however, between the two troubles. The borers attack the trunk of the tree at or near the surface of the ground, working in the inner bark and sapwood, usually making a simple chamber just below the surface of the ground, though sometimes running down several inches on a root or working up the trunk above ground for a short distance. The larvæ probably never leave the burrow to go from one tree to another, but keep on enlarging the chamber until they reach maturity, large exudations of a mucilaginous or gummy nature appearing around the trunk. Trees are often entirely girdled and killed, especially where several borers are in them. The peach tree, however, has great ability to recover from the attacks of the borers.

HABITS AND LIFE HISTORY.

The eggs are laid in midsummer, singly or in groups, on the trunks of the trees near the ground, each female being capable of laying several hundred. About eight days are necessary for the eggs to hatch, and the young larvæ go into the bark sometimes through a crack and sometimes where the bark is smooth, and feed on the inner bark until cold weather, when they suspend operations and hibernate either in the burrow or in a case on the bark. The winter is thus passed as a larva, which goes on feeding in the spring and growing rapidly. As it reaches a large size it makes a larger burrow, and consequently its feeding is much more injurious to the trees than in the fall when it was very small. Great masses of gum exude from the injuries and often the larvæ and particularly the pupæ are enveloped in the masses of gum, which are an indication of the presence of borers in the tree. In June the larvæ become full grown and leave their burrows and pupate in brown cocoons which they make for themselves at the surface of the soil. About three weeks are spent in this stage; then the adult comes forth. The moths are found flying late in June and during July and August. There is but one brood each season.

FOOD PLANTS.

Though a native American insect, it did not at first appear to be much of a peach tree pest, but it has been recorded as

attacking the peach for at least one hundred and fifty years. Sargent states* that the wild black cherry is believed to have been the native food plant of this insect. In 1823, Harris reared the peach borer from cultivated cherry in Massachusetts and thirty years later Fitch found it attacking his plum trees in New York. In 1880, Fuller ascribed the cause of death of his dwarf flowering almond shrubs to this borer. In Connecticut the writer has taken what appeared to be the larvæ of the peach borer from the base of the trunk of the wild black cherry. But as the peach is now cultivated extensively in Connecticut it is only as a pest of the peach that this insect is commonly known.

APPEARANCE OF INSECTS.

The adults of the peach borer are wasp-like moths belonging to the family *Sesiidæ*, commonly called "clear-wings." The female is somewhat larger than the male and has a wing-expanse varying from one to one and a quarter inches. The male has a wing-expanse of about an inch, and is of a bright metallic blue color with yellow markings; both front and rear wings are transparent, with a discal cross mark on the fore wing. The female has transparent rear wings, but the fore wings are opaque blue-black, and there is an orange-colored band encircling the fourth segment of the abdomen. Specimens occur having two orange bands instead of one, the fifth abdominal segment also being orange-colored. The appearance of both sexes is shown in Plate XV.

The egg is minute, oval, brown in color, with the whole surface finely reticulated.

The fully grown larva is about an inch long, rather thick, white, with light brown head and is shown on Plate XV. The pupa is also about an inch long, brown in color, and enclosed in a rough cocoon made up of particles of bark and excrement fastened together with gum and lined with silk.

REMEDIAL TREATMENT.

Many washes and mechanical devices have at various times been originated for preventing the attacks of the peach borer. Some of these devices are not without value; most of them have

* Sylva of North America, vol. 4, p. 11.

long since been discarded by the practical peach grower, who depends upon a careful inspection at least twice a year to destroy the borers. If the trees are examined in September, and again in April or May, and the borers dug out and killed, the expense is probably not greater than any other form of treatment, and is certain to be more effective.

MOSQUITO BREEDING AREAS EXAMINED AT THE REQUEST OF HEALTH OFFICERS.

Early in May the New Haven County health officer, Mr. Carleton E. Hoadley, asked the state entomologist to visit a small pond near Ansonia owned by the Ansonia Water Company, which had been complained about as a source of malarial mosquitoes, malaria having been prevalent the previous season. The visit was made May 12th in company with Mr. Hoadley. A concrete dam had been built, and some ground had been allowed to remain flooded for the purpose of rotting the turf and weeds preparatory to cleaning out. Undoubtedly the pond would breed mosquitoes and probably a great many of them later in the season, but at the time of the visit it was rather early to find wrigglers. The Ansonia Water Company desired to learn about the best treatment to prevent mosquitoes from breeding there. The following brief report was sent to the president of the Water Company:

May 12th, 1909.

"MR. THEODORE BRISTOL, President,
ANSONIA WATER CO.,
Ansonia, Conn.

Dear Sir:—

I visited Ansonia this morning in company with Mr. C. E. Hoadley of New Haven, and examined the small lake where you have built a dam on the hill east of the city. On the south side of this flooded area there is considerable brush, and any attempt to use oil on this would probably not be successful until the brush is cleared off, because in applying the oil it would be quite difficult to cover the surface of the water without wasting a good deal of material on the bushes, which would also interfere with thorough work. If the problem was my own, I should draw off the water, or lower it a foot or so, and cut this brush around the edge of the pond back as far as, or perhaps beyond, the present water line. If you expect to leave the water in it, it would be well to see that it is heavily stocked with some kind of carnivorous fishes, preferably those which feed

near the surface of the water,—pike, pickerel, top minnows, and several other kinds which would answer the purpose. They will devour the mosquito larvæ in the water wherever they can reach them, but in the grass and bushes around the edges, where the water is shallow, it may be impossible for them to reach the mosquito larvæ, and therefore such areas may be prolific breeding places for mosquitoes. From a cursory examination of the place I should feel safe in pronouncing it a place where mosquitoes would breed under ordinary conditions. If the edges could be deepened so that the banks would be abrupt, and kept clean, there would probably be no need of oiling at all, but of course at present the water is shallow and vegetation is apt to grow through it to some extent.

Kerosene can be used for oiling, and should be applied at the rate of one fluid ounce to fifteen square feet of space. It is applied preferably by means of a spray pump, or at least some force pump which will enable one to throw it out for some distance upon the surface of the water. It will spread itself, but it is always well to distribute it as much as possible in applying it. It is always best to put the property in such condition that it will be permanently free from such troubles, because the operation of oiling needs to be repeated once in ten days or so often that in a few years the total expense amounts to even more than the permanent improvement. I shall be glad to answer any further questions in regard to the matter.

Very truly yours,

W. E. BRITTON,

State Entomologist."

Mr. Bristol replied immediately as follows:

"We are pleased to acknowledge receipt of your letter of May 12th, and will follow your suggestions as to drawing off the pond and clearing off the brush on the Parker pond which you examined, because we can see from your statement that you think it is a practical way to treat this proposition."

Later in the season a similar request came from Mr. Hoadley regarding the meadows near the city of Derby, where the new railroad tracks had cut off the natural drainage, forming pools of water more or less stagnant. The place was visited August 12th, and the state entomologist in company with Mr. Hoadley and Dr. J. H. Townsend, secretary of the State Board of Health, were met in Derby by Dr. F. A. Elmes, health officer, and Dr. A. W. Phillips of the State Board of Health, both of Derby.

A choked ditch and two pools between the old Derby railroad and the present location of the Naugatuck railroad contained many wrigglers or larvæ of malarial mosquitoes. As the

health officer wished a statement from this office to submit to the officials of the railroad company the following was sent to him:

Aug. 12, 1909.

"DR. F. A. ELMES,
Derby, Conn.

Dear Sir:—

I herewith submit to you a brief statement of the conditions found on the Derby meadows when examined this morning in company with Dr. J. H. Townsend, secretary State Board of Health, Mr. C. E. Hoadley, County Health Officer, Dr. Phillips, and yourself.

Larvæ or wrigglers of the malarial mosquito (*Anopheles*), were found in the choked ditch running from the old layout of the Derby railroad towards the present location of tracks of the Naugatuck division; also in two large pools near the present tracks, where the construction work formed a dam cutting off the natural drainage.

In the light of our present knowledge, any pool of stagnant water where these mosquitoes breed must be considered a menace to the health of the people in that vicinity, and should be abated. Permanent treatment, such as filling or draining, is always to be advised rather than the temporary expedient of oiling the surface, which in order to be effective must be repeated every ten days through the mosquito season.

Very truly yours,

W. E. BRITTON,
State Entomologist."

FUMIGATING BUILDINGS WITH HYDROCYANIC
ACID GAS.

BY B. H. WALDEN.

In the Sixth Report of the State Entomologist (1906, page 291) is an account of fumigating a dwelling house with hydrocyanic acid gas to kill the bedbug, *Klinophilos lectularia* Linn. This house has been carefully watched for the reappearance of the pest, but not a single specimen of this insect has been found.

Since the publication of the article mentioned above the writer has had charge of fumigating six buildings with hydrocyanic acid gas. Five of the buildings were infested with bedbugs and the sixth, a grain and feed store, was infested with grain insects, principally the saw-toothed grain weevil, *Silvanus surinamensis* Linn. Rats and mice were also doing much damage, especially by gnawing through the bags, allowing the contents to leak out.

As there have been many inquiries received regarding the fumigation of buildings, the operation of fumigating this feed store is herein described.

The building was of brick, 38 x 88½ feet and 4 stories high. Between the first and second story the height was 12½ feet; between the second and third and third and fourth, 11 feet. Between the fourth floor and roof the average was about 5½ feet.

There were comparatively few windows in the building, these being only in the front and back. At the front on the first floor was the office, and on the second floor a room 18 x 20 feet was partitioned off, the remainder of the floor space being used to store the grain; a portion being loose in bins and the remainder stacked in bags.

The fumigating was done on Thursday evening, Friday being a holiday, and the building remained closed until about 8:30 Saturday morning.

The following formula was used, the quantities being for each 100 cubic feet of space:—

Potassium cyanide, 98% C. P.	1 oz. by weight.
Sulphuric acid, commercial	1 oz. by measure.
Water	2 ozs. " "

Below are given the cubic contents of each floor, the amount of cyanide and number of generating dishes used:—

1st floor	42,037 cu. ft.	420 ozs. cyanide.	7 generators.
2d floor	36,992 " "	370 " "	7 "
3d floor	36,992 " "	370 " "	6 "
4th floor	18,498 " "	188 " "	4 "
2 cellars		92 " "	4 "
134,519 cu. ft.		1,440 ozs., or 90 lbs.	

The cyanide for each generator was weighed and placed in a paper bag, after which a bag was placed near the spot where each generator was to be located. The generating dishes, which were cheap wooden water and candy pails, were charged by putting in each the proper amount of water and then slowly stirring in half as much acid. (The water should always be put in first.) These were then placed in position. The operation was made as simple as possible by using equal amounts in all generators on the same floor, the generators of course being placed so as to diffuse the gas as evenly as possible. When everything was ready two men started at the top to drop the bags of cyanide into the generating dishes. The operator should always start at the top of the building and work down, always leaving the generators nearest the exit until the last. In case the cellar has no door leading out into the open air, the bags should be suspended over the generators with strings and arranged so that they can be lowered from the first floor. It is not safe for the operator to go into the cellar and start the generators going and then go to the first floor to work with gas generating above and below him.

The building was locked and left closed for about 40 hours. The doors and a number of the windows were then opened from the outside and the first floor was soon aired so that the building could be entered. As it was not necessary to use the other floors, these were aired gradually, one at a time.

Many dead mice were found scattered over the floors, and a few dead rats, although many of the rats probably escaped, as it is doubtful if the gas would penetrate their burrows, which may have extended for some distance beneath the foundation of the building.

The owner was satisfied with the treatment, and a subsequent visit showed very little recent damage from mice and rats, and no live grain weevils were found.

In each of the buildings fumigated practically the same method was employed, and the formula mentioned above was used.

One of the principal troubles in the work was to get suitable dishes for generators. Dishes made of the iron stone china are satisfactory and the treatment does not injure them, but the heat generated will destroy the glazing of ordinary glazed earthen ware. In one case where the expense was no object the owners purchased a sufficient number of 2 gallon fruit jars for generators. These were ideal for the purpose but cost about 30 cents apiece, increasing materially the cost of the operation.

In fumigating the feed house above mentioned, and in one of the dwelling houses, cheap wooden pails were used. These were purchased for about 15 cents apiece, and were fairly satisfactory, but would sometimes leak, even though thoroughly soaked with water beforehand. If the pails could be treated so as not to leak, they would make very satisfactory cheap generators.

Two of the dwelling houses were completely furnished when fumigated, and no damage was noted to draperies, gilt picture frames, brass bedsteads, etc. Certain gold and brass alloys showed some tarnish, but this seemed to rub off readily.

Each of the buildings which we have fumigated has been closed over night, and where possible it is advisable to do this, but fumigating for 2-3 hours would probably prove effective.

We consider that fumigating with hydrocyanic acid gas is the most thorough treatment that can be given for household insects. This is one of the most deadly gases known, and great care must be taken throughout the whole operation. The house should be thoroughly aired before entering, and anyone sleeping in a house recently fumigated should see that there is abundant ventilation until all traces of the gas are out of the building.

MISCELLANEOUS INSECT NOTES.

TOBACCO BUD WORM IN CONNECTICUT.

About September 15th some unusual green caterpillars were found feeding upon the experimental tobacco plants, growing on the Station grounds. These were placed in breeding cages and

supplied with food. One pupated September 15 and the others a few days later. On October 11th one adult moth emerged from the cocoon, and two appeared October 21st. On obtaining the adults, we were able to identify the species as *Chloridea virescens* Fabr., formerly known as *Heliothis rhexiae* S & A and called the "true bud worm" to distinguish it from *Heliothis obsoleta* Fabr. which is called the "false bud worm."

The adult of *Chloridea virescens* is a greenish moth having a wing expanse of one and one-half inches and is shown in figure 6. Each fore wing is transversed by the lighter bands.

Quaintance mentions* this species as attacking the tobacco crop in Florida but states that it is less troublesome than *Heliothis*



Fig. 6. The Tobacco Bud Worm Moth. Natural size.

obsoleta. Howard† states that it has not been noted in tobacco fields north of Maryland. In Dyar's List of N. A. Lepidoptera the distribution of this species is given as "United States."

CANKER WORMS.

Much damage was done locally to orchard and shade trees throughout Connecticut in 1909, but the warning was given, the danger pointed out and relief measures recommended in the last report of this office (see Report of this Station for 1907-1908, page 777), to which the reader is referred for a full account of this insect. In spite of the warning, however, there were scores of good apple orchards stripped of their leaves in May and looking as if a fire had run through them. However, there were orchards scattered here and there attacked by Canker Worms which were carefully sprayed by the owners and all damage prevented; these served as excellent object lessons to the communities in which they are located.

On account of the great damage caused by Canker Worms in 1909, and the abundance of adults in the late fall and later the

* Florida Agr. Expt. Sta. Bull. 48, p. 184, 1898.

† Year Book U. S. Dept. of Agr. for 1898, p. 132.

eggs on the trees, it is reasonable to expect serious injury again in 1910, and the only treatment that can now be given is to spray the foliage in May, using preferably lead arsenate at the rate of about 3 lbs. in 50 gallons of water.

THE GREENHOUSE LEAF-TYER.

On January 17th Mr. Wm. J. Rowe, gardener to Mr. Joel Sperry of Whalley Avenue, New Haven, Conn., brought to the Station some caterpillars which were injuring greenhouse cinerarias and daisies by devouring the leaves. The following description of the larva and the accompanying drawing (figure 7) were prepared by Mr. Caffrey.

Average length 14mm. Average width 3mm. General color, light green along dorsal surface with a light greenish yellow

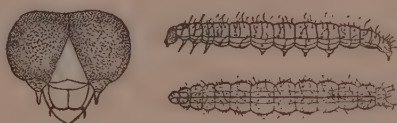


Fig. 7. The greenhouse leaf-tyer. Side and dorsal view of larva two and one-half times natural size. Also front view of head, greatly enlarged.

tinge on lateral and neutral surfaces. A narrow dark green median stripe extends along the dorsal surface from behind the head to the last segment. Four rows of bristles on each side of mid-dorsal line extending length of body with one bristle on each segment except the row next to mid-dorsal line on each side, which has two bristles on each segment. Head has a light brown tinge with darker brown spots.

On January 21st one of the caterpillars spun a cocoon and transformed to the chrysalis or pupa stage and the others soon followed suit. The first moth emerged on Feb. 10th. The insect proved to be *Phlyctænia ferrugalis* Hubn. (*rubigalis* Guen) and is illustrated on Plate XVI, b.

This species is known as the greenhouse leaf-tyer and according to Chittenden* has caused considerable damage to greenhouse and field plants, including vegetables, during the past few years. The larva works on the under side of the leaves, often fastening

* Bureau of Entomology, Bull. 27, N. S., p. 7.

two together with silken threads or curling the edge of the leaf on which it may be feeding, and enclosing itself in a thin web.

The adult is a slender species with a wing-expanse of about three-fourths of an inch and of a pale reddish brown color, with inconspicuous markings. It is said that there are at least two and perhaps more annual generations out of doors, and more—probably five or six—in greenhouses. There are published records of the occurrence of this insect throughout the eastern states and in California.

The list of food plants includes cabbage, beets, celery and tobacco, rag weed, hedge mustard, and a large number of greenhouse and outdoor ornamental plants.

The whitish translucent eggs are deposited either singly or in masses of eight or ten on the under side of the leaf; they hatch in a period varying from five days to nearly three weeks. The larval period lasts from three to five weeks according to temperature and the pupal period usually about two weeks.

The adults fly just before sundown and usually rest during the day on the under side of the leaves of the plants, upon which the larva feed. When at rest the wings are folded in the manner common to most *Pyralid* and *Deltoid* moths.

Wherever much damage is done or the caterpillars are sufficiently abundant to cause apprehension, the plants may be poisoned by spraying them with lead arsenate or by dipping them into the liquid. The poison should be mixed at the rate of about one pound in ten gallons of water.

Where spraying is practiced it is necessary to apply the poison to the under sides of the leaves. Chittenden advises* fumigating the house in serious infestations and gives directions for carrying out the treatment. For general fumigation from one-tenth to fifteen-hundredths of a gram of 98% potassium cyanide for each cubic foot of space should be used.

STRAWBERRY CROWN GIRDLER ATTACKING YOUNG HEMLOCKS.

On June 16th samples of injured hemlock trees were brought to the station from a nursery in New Haven. The trees were between twelve and eighteen inches in height and had been growing in nursery rows for one and two years. They had shown signs of unthriftiness by turning brown and dropping their leaves.

* Idem, p. 20.

Some failed to make any growth. On examining the roots it was found that insects were at work in the bark of the main stem and larger roots. Larvæ pupæ and adults of a small beetle were found in the bark and in the soil near the tree. Of 4,000 young trees about 200 were destroyed by this insect, which proved to be the Strawberry Crown Girdler *Otiorhynchus ovatus* Linn. of the family Otiorhynchidæ and closely allied to the curculios. It usually feeds upon the roots and crowns of strawberry, grass and many other plants. Though I have not found Hemlock mentioned as a food plant, it is known to be a general feeder, and the larvæ of another and much larger species of the same genus *O. sulcatus* Fabr. are known to feed in Hemlock bark. The injured hemlock trees were from western nurseries and were grown in frames a year before setting and were near the spot where strawberries had been growing the preceding year, which possibly may explain the attack.

The Strawberry Crown Girdler is not a native to America but occurs in northern Asia and Europe and probably came to us from Europe. It has also been called the strawberry weevil, the pitchy-legged Otiorhynchus, and in certain localities has acquired the name of "graveyard bug," probably because it was abundantly feeding upon the grass in a cemetery. It occasionally causes serious damage to strawberries in Connecticut by eating the roots and crowns of the plants. Remedial treatment with insecticides is rather unsatisfactory and cultural methods must be relied upon chiefly to control this insect. As the larvæ feed normally upon the roots of grass and various plants, Cooley suggests* that "the remedial measure that seems to promise most is so managing the soil that where it is desired to set out the field to strawberries the beetles will have previously starved out."

Miss Patch reports† this beetle as being abundant in houses in several localities in Maine in 1905. Though housekeepers were alarmed, the Strawberry Crown Girdler does no harm in the house. It simply seeks a hiding place, though not entirely for hibernation, and the houses afford a convenient place.

Miss Patch gathered several hundred adult beetles and confined them to learn something about their feeding habits. She

* Montana Agr. Expt. Sta. Bull. 55, 1904.

† Maine Agr. Expt. Sta. Bull. 123, 1905.

then collected leaves and flowers of various plants and placed before them. In this manner they were observed to feed to a greater or less extent upon about fifty different kinds of trees and plants, not including, however, hemlock.

The adult beetle is nearly one-fourth of an inch long and varies from light reddish brown to nearly black in color. Like some other allied species, the Strawberry Crown Girdler has thick wing covers but no wings. Consequently it is not able to fly and does not spread very rapidly.



Fig. 8. The Strawberry Crown Girdler. Enlarged three times.

This insect is shown in figure 8. The Station collection contains specimens of this beetle from Colebrook, Windsor, Waterbury, Stratford and New Haven.

WHITE GRUBS IN GRASS LANDS.

Reports have been received from different parts of the state of injury to grass land last season by white grubs which eat off the roots. The damage becomes noticeable late in summer, after the hay crop has been harvested, especially if two or more seasons of drought at this time have occurred. The roots are devoured so that the turf can be peeled or scraped from the soil in large areas; in former years I have seen acres in this condition in the State of New Hampshire, and in some fields the ground was literally torn up by skunks which dig to get the grubs for their food. Give the skunks credit for doing a little good. The localities reported in Connecticut are Oxford, Salem and Meriden. One man asks if the grubs will be troublesome next season, and if it will be safe to plant corn, strawberries or other hoed crops on the land next year. Though it is scarcely safe to prophesy regarding the occurrence or absence of insect pests, there are certain general laws and conditions which we may consider. For instance, the white grub is the larva of the "May beetle" or "June beetle," shown in figure 9, of which

there are several species, and three years are required for the insect to pass through its entire period of development from the egg to the adult beetle. Grass lands are seldom injured by the grubs except when they are numerous and nearly full grown. It is fair to assume, therefore, that those grubs doing the damage in the summer of 1909 will not feed another season, but will transform or perhaps have already transformed, and that



Fig. 9. A common "June Beetle" *Lachnosterna fusca* Froehl. Natural size.

the beetles will emerge in May and June to lay eggs for the succeeding generation. We may expect the beetles to be very abundant. In planting the land to other crops, it is advisable to give it a good plowing and thorough harrowing with a disk or cut-away harrow, and these preparatory operations will kill many of the insects before they emerge.

A word as to remedies. It has often been advised that heavy applications of common salt, lime, kainit or muriate of potash be applied to the grass land as soon as the damage is first noticed to kill the grubs. It is a question whether this practice is worth while, though the application of any good fertilizer is of value as plant food. Usually it is best to plow the ground, and sometimes a crop of Hungarian grass or millet can be grown the same season. In other cases it can be sown to rye. If no crop is put upon the land immediately, it is best to plow the ground late in the fall, as many of the grubs will thus be exposed and devoured by crows or blackbirds or killed by the elements. If the field can be pastured with pigs, they will destroy most of the grubs and beetles.

WHITE ANTS INJURING A HOUSE IN SOUTH NORWALK.

Specimens were received from South Norwalk on April 19th with the report that they were eating through the solid wood

of the construction timbers and finish boards of a dwelling house. The specimens were a common insect—known as white ant *Termes flavipes* Kollar, though not an ant at all and not closely related to the ants, but given the popular name of white ant on account of its appearance and habits. There are several species of white ants in the tropics, and some of them do a great amount of damage. *T. flavipes* is rather common in Connecticut, often nesting in old stumps, in fence posts, or in buildings. The writer has noticed large numbers of individuals swarming along the sidewalks, where they had emerged from the strip of board laid to hold the edge of the tar walk. One season they were nesting in the board walks in the Station greenhouse. The greenhouse was afterward fumigated with hydrocyanic acid gas and the white ants disappeared. Carbon bisulphide is perhaps the best remedy if it can be poured into the nest and the opening stopped.

GREEN ROSE CHAFER IN PACKAGE OF NURSERY STOCK IMPORTED
FROM EUROPE.

When inspecting some ornamental nursery stock imported from Holland at a nursery in New Haven in April, 1909, a living specimen of *Euphoria* (*Cetonia*) *aurata* Linn. was found in the packing. It is needless to say that the specimen was immediately placed in the cyanide bottle and now reposes in the Station collection. This beetle is a large and handsome species of bright metallic green color marked crosswise with small whitish spots or streaks and is shown on Plate XVI, c.

The green rose chafer is considered a pest in Europe—the grubs feeding upon the roots of strawberries, grass and other plants and the adult beetles attack various flowers, such as strawberry blossoms and roses.

Eggs are laid in the ground where the grubs feed for two or three years. The grubs are nearly an inch and a half long when full grown and are of a dirty white color with the posterior extremity grey and with a yellow head. They make their pupal cases in the soil in the same manner as our white grubs, which they closely resemble.

A brief account of the green rose chafer is contained in "Manual of Injurious Insects and Methods of Prevention" by Eleanor A. Ormerod, London, England, 1890.



a. Showing boxes of imported stock in packing shed.



b. Inspecting stock at the nursery.

INSPECTION OF IMPORTED NURSERY STOCK.





Egg-clusters on maple street-tree: about 300 were counted on this tree.

GYPSY MOTH AT WALLINGFORD.





GYPSY MOTH EGG-CLUSTERS ON BASE OF APPLE TREE.





Nearly 300 egg-clusters were found on these trees,

INFESTED WILLOWS AT WALLINGFORD.





Tree, building, fences and tinware were infested with egg-clusters.

CONDITIONS IN AN INFESTED BACKYARD AT WALLINGFORD.





EGG-CLUSTERS AND OLD COCOONS ON APPLE TREE, WALLINGFORD.





a. Nearly fifty egg-clusters were found on this roof.



b. General view of one of the worst-infested backyards.

GYPSY MOTH WORK, WALLINGFORD.





a. Examining the fence and destroying egg-clusters.



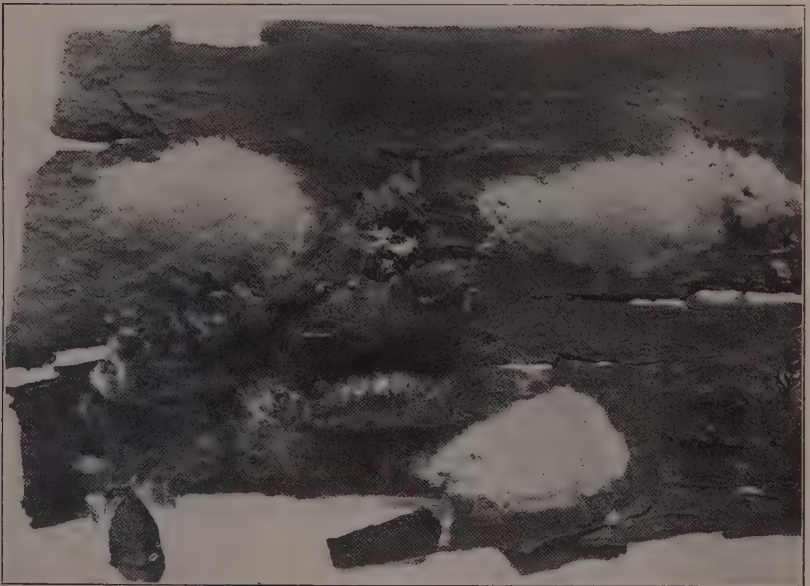
b. This pile of kindling wood contained about fifty egg-clusters.

DESTROYING GYPSY MOTH EGGS, WALLINGFORD.





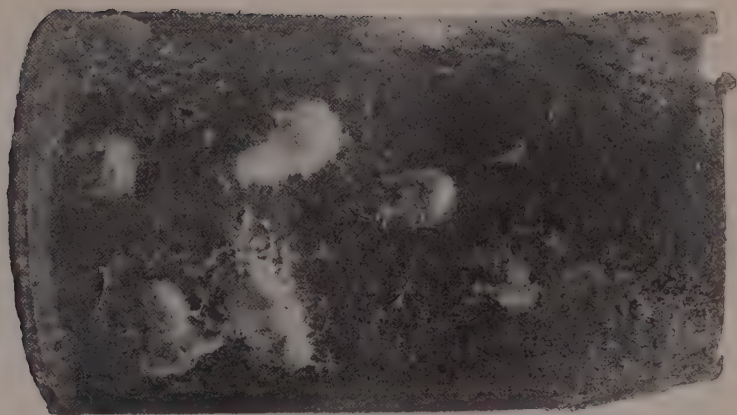
a. Egg-clusters on brick underpinning.



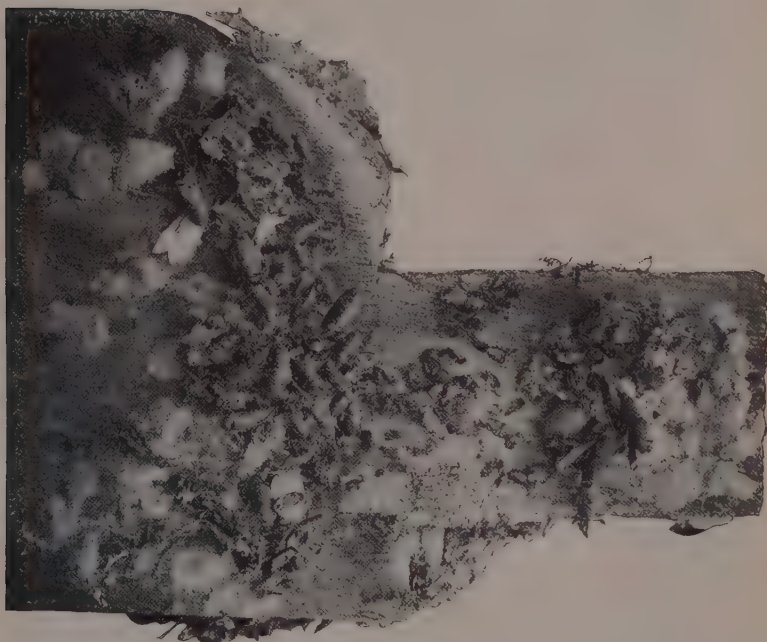
b. Egg-clusters on inside of loose hickory bark.

GYPSY MOTH EGG-CLUSTERS. Natural size.





a. This coffee can had 21 egg-clusters on and in it.



b. Dead moths, egg-masses and old cocoons under board lying upon the ground.

WALLINGFORD GYPSY MOTH INFESTATION.



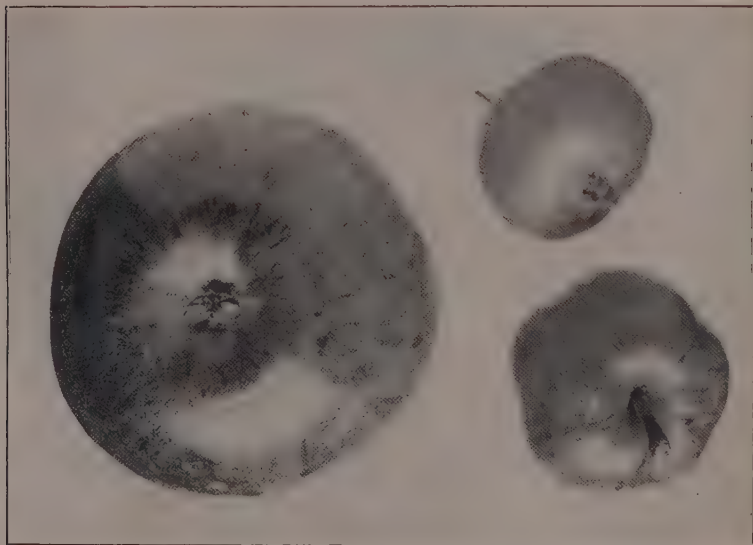


DESTROYING GYPSY MOTH EGG-CLUSTERS AT WALLINGFORD.





a. Cluster at right badly infested, showing difference in size from normal fruit at left, not infested.



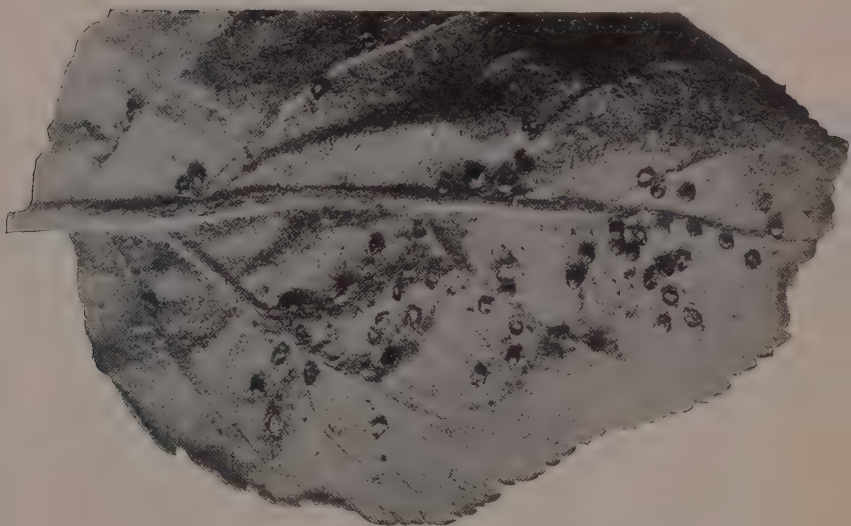
b. Normal size of fruit at left ; those at right checked by attack of aphis.

ROSY APPLE APHIS.





a. Badly infested cluster, causing stunted and irregular fruit.



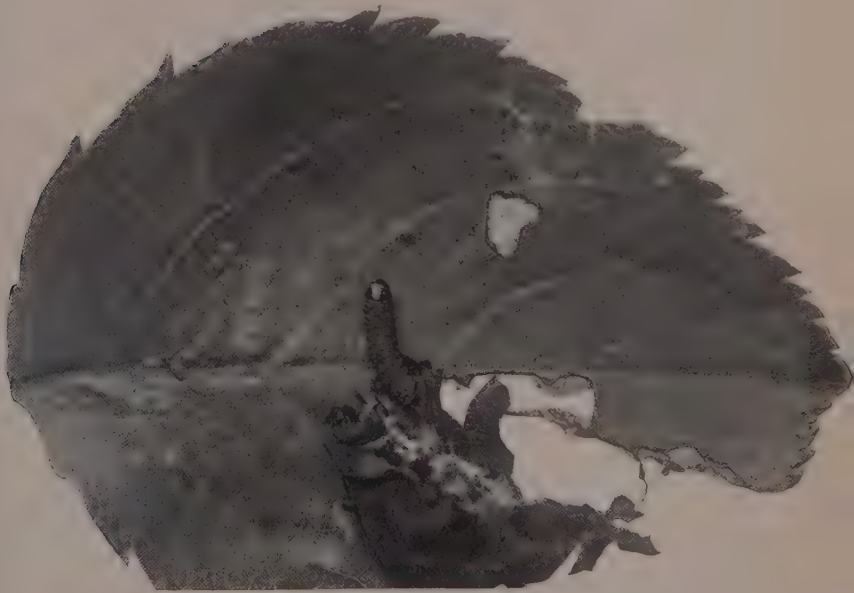
b. Apple leaf showing parasitized aphids twice natural size.

ROSY APPLE APHIS.





a. Young apple leaves infested by bud moth, natural size.



b. Apple leaf and bud moth caterpillar, twice natural size.

BUD MOTH.



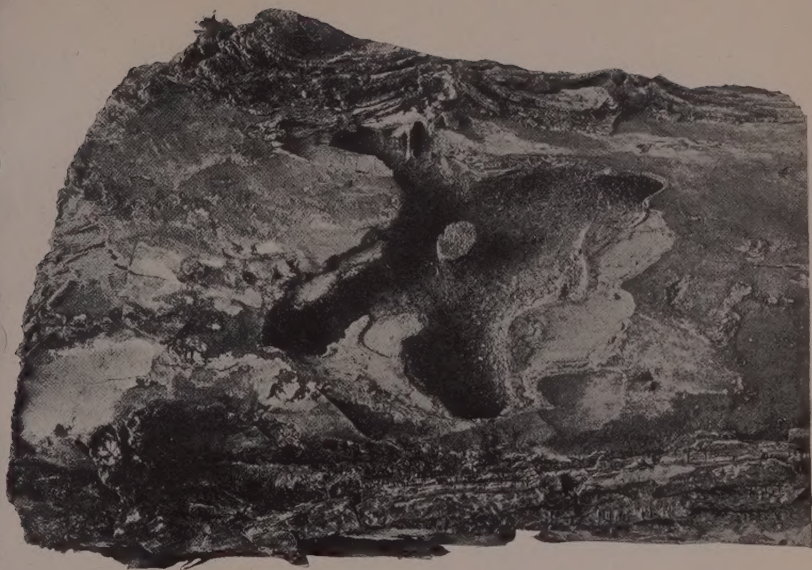


b. Female peach borer moth,
twice natural size. (After Beutenmuller.)



c. Male peach borer moth,
twice natural size. (After Beutenmuller.)

a. Larva in its burrow in young
peach tree.



a. Elm branch showing galleries of the Leopard moth larva.



b. Adult of the Greenhouse Leaf-Tyer.
Twice natural size.



c. European Green Rose Chafer.
Twice natural size.

EUROPEAN GREEN ROSE CHAFER, GREENHOUSE LEAF-TYER AND WORK
OF LEOPARD MOTH.



INDEX.

	Page
<i>Ancylus nubeculana</i>	353
<i>Anopheles</i>	325
Ants, White	373
Aphis, Green apple	344
<i>Aphis malifoliae</i>	344
<i>pomi</i>	344
<i>pyri</i>	344
Aphis, Rosy apple	343
Description	345
Parasites	351
<i>Aphis sorbi</i>	344
Apiaries, Inspection work	331
Apple aphis, Rosy	343
Description	345
Parasites of	351
Remedial treatment	351
Bedbug	365
Bees, Act concerning suppression of contagious diseases among	332
Brown-tail moth	328
Bud moth	353
Description	354
Remedies	355
Bud worm, False	368
Tobacco	367
True	368
Canker worms	368
<i>Cetonia aurata</i>	374
<i>Chilocorus bivulnerus</i>	351
<i>Chloridea virescens</i>	368
Correspondence	325
<i>Culex</i>	325
Elm trees, Municipal spraying of	334
<i>Euphoria aurata</i>	374
<i>Euproctis chrysorrhoea</i>	328
Exhibits	325
Expenditures	323
False bud worm	368
Field organization	324
Fumigating buildings with hydrocyanic acid gas	365
Green apple aphis	344
Green rose chafer	374
Gypsy moth account, Expenditures	324
Receipts	324
in Stonington	336
in Wallingford, Discovery of	337
Suppression work	342
<i>Heliothis obsoleta</i>	368
<i>rhexiae</i>	368
Hydrocyanic acid gas, Fumigating buildings with	365
Insect notes, Miscellaneous	367
Inspection work, Apiary	331
Nursery	326
" Imported stock	328
Summary of	325

	Page
Kerosene emulsion, Formula	352
<i>Klinophilos lectularia</i>	365
<i>Lachnosterna fusca</i>	373
Leaf-tyer, Greenhouse	369
Lectures	325
Leopard moth	356
Description	358
Remedies	358
<i>Leucospis nigricornis</i>	351
<i>Lysiphlebus cucurbitaphidis</i>	351
" <i>myzi</i>	351
<i>Megorismus fletcheri</i>	351
Mosquito breeding areas, Ansonia	362
Derby	363
Moth, Brown-tail	328
Bud	353
Gypsy,	324, 336
Leopard	356
Nursery firms receiving certificates in 1909	327
" inspection	326
Office force	324
<i>Otiorhynchus ovatus</i>	371
<i>sulcatus</i>	371
Peach borer	359
Description	361
Remedial treatment	361
<i>Phlyctaenia ferrugalis</i>	369
" <i>rubigalis</i>	369
<i>Prionidus cristatus</i>	351
Publications	326
Receipts	323
Rose chafer, Green	374
Rosy apple aphid	343
Description	345
Parasites of	351
Remedial treatment	351
<i>Sanninoidea exitiosa</i>	359
<i>Silvanus surinamensis</i>	365
Spraying elm trees	334
List of firms engaged in	335
Strawberry crown girdler	370
Submittal, Letter of	323
<i>Termes flavipes</i>	374
<i>Tmetocera ocellana</i>	353
Tobacco bud worm	367
True bud worm	368
White ants injuring a house	373
" grubs in grass lands	372
<i>Zeuzera pyrina</i>	356